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CONTROLLING SPACE WEAPONS

HEARINGS

BEFORE THE
COMMITTEE ON FOREIGN RELATIONS
UNITED STATES SENATE
NINETY-EIGHTH CONGRESS

FIRST SESSION

ON

S. RES. 43

A RESOLUTION EXPRESSING THE SENSE OF THE SENATE
THAT THE PRESIDENT OF THE UNITED STATES INVITE THE
SOVIET UNION TO NEGOTIATE A VERIFIABLE BAN ON ANTI-
SATELLITE WEAPONS AS A FIRST STEP TOWARD PROHIBIT-
ING ALL SPACE-BASED AND SPACE-DIRECTED WEAPONS

S.J. RES. 28

A JOINT RESOLUTION CALLING FOR IMMEDIATE NEGOTIA-
TIONS FOR A BAN ON WEAPONS OF ANY KIND IN SPACE

APRIL 14 AND MAY 18, 1983

Printed for the use of the Committee on Foreign Relations



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(II)

CONTENTS

Hearing days:	Page
April 14, 1983-----	1
May 18, 1983-----	71
Statement of—	
Adelman, Hon. Kenneth L., Director, Arms Control and Disarmament Agency-----	77
Deudney, Daniel, senior researcher, Worldwatch Institute, Washington, D.C.-----	31
Garwin, Richard L., IBM Thomas J. Watson Research Center, adjunct professor of physics, Columbia University, Andrew D. White professor-at-large, Cornell University; adjunct research fellow, Kennedy School of Government, Harvard University, Yorktown Heights, N.Y.-----	130
Gayler, Admiral Noel (USN, Ret.), former Director, National Security Agency; former Commander in Chief, U.S. Forces in the Pacific; former Deputy Chief of Naval Operations (research and development), Fairfax, Va.-----	139
Gottfried, Kurt, director, Union of Concerned Scientists, Washington, D.C.-----	112
Graham, Lt. Gen. Daniel O., U.S. Army (Ret.), director, High Frontier, Washington, D.C.-----	29
Ikle, Hon. Fred. C., Under Secretary for Policy, Department of Defense-----	100
Lodal, Jan M., former staff member, National Security Council, Arlington, Va.-----	16
Rathjens, George, Massachusetts Institute of Technology, former Deputy Director, Defense Advanced Research Projects Agency, West Newton, Mass.-----	21
Rosin, Carol, president, Institute for Security and Cooperation in Outer Space, Inc., Clarksville, Md.-----	149
Insertions for the record:	
Text of Senate Resolution 43 and Senate Joint Resolution 28-----	4
Excerpts from President Reagan's speech of March 23, 1982-----	10
Letter to Senator Pressler from former Secretary of State Dean Rusk, dated June 1, 1983, concerning the arms race in outer space-----	11
Avoiding a crippling space-weapons race—reprinted from the Los Angeles Times, January 6, 1983-----	12
Bar weapons in space—reprinted from the New York Times, January 13, 1983-----	13
Warning: Danger in space—reprinted from the New York Times, April 11, 1983-----	14
Prepared statement of Jan M. Lodol-----	19
Biographical data of George Rathjens-----	21
Prepared statement of George Rathjens-----	24
Biographical data of Daniel Deudney-----	31
Prepared statement of Daniel Deudney-----	34
Excerpted statement of Dr. Robert Cooper, Director, DARPA, before the Senate Armed Services Committee, March 1982-----	49
Dr. Cooper's response to Senator Warner on the ABM Treaty-----	53
No, Mr. Reagan, it won't work—reprinted from the Washington Post, March 27, 1983-----	57
Reagan's new idea—what about it?—reprinted from the Washington Post, March 27, 1983-----	58
It may be plausible—and it may be ineffective—reprinted from the Washington Post, March 27, 1983-----	60

IV

Insertions for the record—Continued

	Page
An expensive technological risk—reprinted from the Washington Post, March 27, 1983.....	62
100 percent defense? Hardly—reprinted from the Washington Post, March 27, 1983.....	63
Excerpts from Secretary of State William Rogers' letter transmitting the ABM Treaty to President Richard Nixon (June 1972).....	64
Excerpt of statement by Secretary of State William Rogers before the Senate Foreign Relations Committee (June 1972).....	68
Excerpt of statement by Ambassador Gerard Smith, before the Senate Armed Services Committee (June 1972).....	68
Heading off bad space policies—reprinted from the Christian Science Monitor, April 19, 1983.....	73
Prepared statement of Hon. Paul E. Tsongas.....	75
Prepared statement of Hon. Kenneth L. Adelman.....	82
The hole in Andropov's Space-Weapons Treaty, a letter to the editor, by Senator Pressler—reprinted from the New York Times, May 8, 1983.....	87
Prepared statement of Hon. Fred C. Ikle.....	102
Prepared statement of Kurt Gottfried and the report of the Union of Concerned Scientists.....	114
Biographical data of Richard L. Garwin.....	129
Prepared statement of Richard L. Garwin.....	132
Scientists fault charges of Soviet cheating—reprinted from Science, May 13, 1983.....	145
Prepared statement of Carol Rosin.....	152
ACDA's responses to additional questions submitted for the record....	160
Dr. Gottfried, Admiral Gayler and Dr. Garwin's responses to additional questions submitted for the record.....	163
Appendix:	
War and peace in the space age—address to the U.N. Committee on Disarmament, Geneva, September 31, 1982, by Arthur C. Clark, chancellor, University of Moratuwa, Sri Lanka.....	167
The High Frontier proposal: a CDI Critique.....	171

CONTROLLING SPACE WEAPONS

THURSDAY, APRIL 14, 1983

UNITED STATES SENATE,
COMMITTEE ON FOREIGN RELATIONS,
Washington, D.C.

The committee met, pursuant to notice, at 2:40 p.m., in room SD-419, Dirksen Senate Office Building, Hon. Larry Pressler presiding.

Present: Senators Percy, Helms, Pressler, and Pell.

Senator PRESSLER. I will call the committee meeting to order and thank our witnesses for their patience. We had a vote. We thank you very much for being here and we appreciate your patience. I have an opening statement and then I will call on my colleague, Senator Helms, for his statement and then we will proceed, if that is agreeable.

This is the second in a series of hearings that will consider the direction of United States and Soviet space weapons programs and their arms control implication. I opened the first hearing last September by noting that since the time I had initially offered a Senate resolution on space arms control in May 1981, there has been little movement toward negotiations and a great deal of activity indicating that we are on the verge of a United States-Soviet space weapons race. This race is not confined to killer satellites alone. Both countries are now developing a number of exotic space-based and space-related weapons.

Events in recent weeks and months have reinforced this conclusion. Indeed, space weapons activities continue to accelerate and still there is no movement to the negotiating table.

Before turning to the main theme of this hearing, I should note that since the first hearing on space arms control issues and today's hearing, the United States crossed the quarter century mark in space exploration. In these 25 years, space technology has made a major impact upon our way of life. Besides applications in the military field, satellites are playing important roles in science and in commerce. Space systems are assisting our search for new sources of energy and meteorological satellites have aided farms production. Communications satellites not only provide rapid access to our troops abroad, but they help our business leaders to conduct financial transactions.

In the next quarter century, this trend can continue. But much depends upon our ability to develop policies and policymaking tools which will maximize developments in space technology. Unfortunately, it seems that technology has begun to outpace our ability to manage it. This can lead to inefficient use of this technology and ill-conceived notions on how best to utilize its potential.

The move toward space weapons is only one example of this. We seem to be entering a space weapons race before fully assessing

whether such a race is in our interest, or whether a space arms race can be avoided. In another field, that of remote sensing satellites and weather satellites, we seem to be moving away from Government leadership well before the private sector has demonstrated that it can operate these programs in a cost-effective manner. Internationally, there are efforts by some of the world's developing states to politicize the process of allocating orbital space assignments. Using international bodies, such as the International Telecommunications Union [ITU], these nations are blocking the application of new technologies, such as direct satellite broadcasting. Increasingly, the ITU looks like the Law of the Sea negotiations, with some nations seeking a free ride on American shoulders.

We in the United States lack a coherent policy to meet these challenges. Unless we begin to conceive a comprehensive approach that covers all the dimension of space utilization—military, scientific, and commercial—we cannot hope to maintain U.S. leadership in space.

Today's hearing will focus on one segment of this important area: The role of arms control in space. Let me begin this session by saying that a space weapons race could have grave consequence and we must not engage in it lightly, if we are to serve the interests of the American people and of our allies. A move toward space arms represents the most revolutionary shift in strategy since the advent of nuclear weapons. In this regard, this hearing is scheduled at a most propitious time. At the moment that we meet here, a group of distinguished scientists are meeting in Los Alamos, N. Mex., to commemorate the 40th anniversary of the Manhattan project that produced the world's first atomic bomb. It is important that we keep that development and its implications in mind as we assess the possible consequences of a space weapons race.

I fully support a strong defense for America, but it is far from certain that a space arms competition is a way to assure it. A space arms competition would be very expensive, and it could undermine our ability to correct existing deficiencies in our Armed Forces. Given our Nation's dependence on space systems for keeping the peace, space weapons would compromise many valuable U.S. military assets in space.

Let me cite some statistics. The U.S. F-15 based antisatellite [ASAT] weapon, which, according to press reports, will be tested this summer, will cost tens of billions of dollars, according to a GAO study. But we are now informed by Aviation Week, that Space Command no longer regards this conventionally armed ASAT as good enough and that we must move toward a laser ASAT weapon. Last year a Defense Department study put a price tag of \$50 billion on such a laser weapon. That estimate is probably too low, given the many uncertainties that will have to be tackled in deploying laser weapons.

The President has helped to focus attention on the future of space weapons by his March 23 speech. The hope of moving away from deterrence toward a policy that would end the tyranny of nuclear weapons is admirable. But as President Reagan noted, unless we can significantly reduce nuclear weapons before we deploy a laser defense, such a defense could be viewed as fostering an aggressive policy. In considering the development and deployment of space-based weapons, we must give serious consideration to this and to other long-term implications for strategic stability.

In the meantime, the United States should continue its research efforts on ballistic missile defense [BMD] systems. This is the only prudent course to follow, if we are to avoid a dangerous and destabilizing Soviet technological breakthrough. We cannot and must not be caught off guard for this is an area that is under active investigation in the Soviet Union. I ask that the relevant excerpts from President Reagan's speech be included in the record at the conclusion of my remarks.

Once started, the momentum of a space weapons race will be strong and verification problems could make space arms control agreements extremely difficult, if not impossible, to achieve. Therefore, unless we can reverse the trend toward space arms quickly, the deployment of increasingly advanced and exotic weapons, such as laser defenses, may become unavoidable.

As noted, ASAT weapons are very expensive. These systems meet and often surpass the cost of the MX missile which has received much greater budgetary attention in the Senate. In cost terms, space-based missile defenses would likely dwarf ASATs. According to Dr. Robert Cooper, director of DARPA, a conventionally armed ballistic missile defense would cost from \$200 to \$300 billion. Similarly, a Defense Department study concludes that a missile defense based upon more advanced laser weapons would cost \$500 billion. That is twice as much as the entire defense budget for this year.

We must approach a space arms competition with the greatest of caution. It is not wise to assume that in the long run such a space race will serve our Nation's interests. Before we dare join this race, we must first examine its potential risks for strategic stability and its great cost to the American taxpayer. In proceeding, arms control must be given a serious try. A space arms competition may still be avoidable and a weapons ban might still be verifiable. But that requires a return to United States-Soviet negotiations. Given sufficient seriousness on both sides, we can still hope to halt these developments. Should talks fail, we would retain our weapons option.

For these reasons, I have offered Senate Resolution 43 which includes as sponsors Senators Percy and Pell and six other Senators, including four other Senators on this committee. Senate Resolution 43 calls for negotiations on a verifiable ban on antisatellites as a first step toward prohibiting all space-based and space-directed weapons. It is a refinement of two previous resolutions.

I favor negotiations that would ban all space weapons, but I believe that negotiating such a ban is a complex task. If we are to succeed in negotiations, we must deal with first things first. Given the imminent danger of an ASAT competition, Senate Resolution 43 urges that we immediately resume ASAT talks as a first phase in negotiations that would deal with all space weapons. I ask that Senate Resolution 43 be printed in the record of this hearing together with an article by Flora Lewis in the New York Times of April 11, 1983, urging Senate action on this resolution. I also ask that two op. ed. articles that I wrote for the New York Times and the Los Angeles Times be printed at the conclusion of my remarks.

I requested that Defense Secretary Weinberger and other administration witnesses testify at this hearing. The administration has decided to withhold testimony until it concludes a review of U.S. space policy. We will hear from the administration in a hearing next month.

[Text of S. Res. 43 and S.J. Res. 28 follows:]

98TH CONGRESS
1ST SESSION

S. RES. 43

Expressing the sense of the Senate that the President of the United States invite the Soviet Union to negotiate a verifiable ban on antisatellite weapons as a first step toward prohibiting all space-based and space-directed weapons.

IN THE SENATE OF THE UNITED STATES

FEBRUARY 2 (legislative day, JANUARY 25), 1983

Mr. PRESSLER (for himself, Mr. PERCY, Mr. PELL, Mr. MATHIAS, Mr. CRANSTON, Mr. PROXMIRE, and Mr. D'AMATO) submitted the following resolution; which was referred to the Committee on Foreign Relations

RESOLUTION

Expressing the sense of the Senate that the President of the United States invite the Soviet Union to negotiate a verifiable ban on antisatellite weapons as a first step toward prohibiting all space-based and space-directed weapons.

Whereas the United States depends upon satellites for preserving the peace through command and control of United States forces worldwide and through early warning of strategic attack, among other functions;

Whereas satellites are vital for verification of arms control agreements;

Whereas the safety of such important missions including those performed by the Space Shuttle would be compromised by the threat posed by killer satellites;

Whereas a space arms race would undermine strategic stability;

Whereas a military space race would add to the uncertainties faced by military planners and thereby complicate the task of designing an effective military force structure;

Whereas an arms race in space would be a drain on the American taxpayer and would undermine our ability to correct current deficiencies in our military posture;

Whereas the United States and other nations rely increasingly on space-based systems for weather forecasting, communications, natural resource exploration and other important commercial activities;

Whereas the maximum utilization of space technology for commerce and science is assured only under peaceful conditions;

Whereas the unregulated deployment of hazardous space systems, even if intended for nonweapons purposes, poses a serious danger to human life; and

Whereas the present pace of military space developments will soon reduce the prospects of avoiding the weaponization of outer space: Now, therefore, be it

1 *Resolved*, That it is the sense of the Senate that—

2 (a) the President should immediately prepare a
3 proposal and invite the Soviet Union to negotiate a
4 verifiable ban on the development, testing, production,
5 and deployment of antisatellite weapons as a first step
6 toward prohibiting all space-based and space-directed
7 weaponry;

8 (b) these negotiations should also seek to restrict
9 to the extent consistent with United States national in-

1 terest the deployment of hazardous objects and materi-
2 als, such as nuclear materials in outer space; and

3 (c) in pursuing agreement with the Union of
4 Soviet Socialist Republics on antisatellite weapons, the
5 President should agree to no provision that would in
6 any manner restrict the development and operation of
7 the Space Shuttle or impede legitimate activities per-
8 mitted under the SALT I ABM Treaty.

98TH CONGRESS
1ST SESSION

S. J. RES. 28

Calling for immediate negotiations for a ban on weapons of any kind in space.

IN THE SENATE OF THE UNITED STATES

FEBRUARY 3 (legislative day, JANUARY 25), 1983

Mr. TSONGAS (for himself, Mr. HATFIELD, and Mr. HART) introduced the following joint resolution; which was read twice and referred to the Committee on Foreign Relations

JOINT RESOLUTION

Calling for immediate negotiations for a ban on weapons of any kind in space.

Whereas the peaceful exploration of space has greatly benefited the development of the theoretical and applied sciences and the continued peaceful exploration of space offers and enormous potential for expanding the limits of our knowledge and providing additional benefits to the human race;

Whereas mankind's continued preoccupation with developing weapons and destruction already threatens the quality and existence of life on Earth as we know it;

Whereas the quality and existence of such life will face an even greater threat should the arms race be extended into space; and

Whereas an international agreement to prohibit the introduction of weapons of any kind into space is needed in order to avoid the financial, social, and human costs that could result from such an arms race: Now, therefore, be it

1 *Resolved by the Senate and House of Representatives*
2 *of the United States of America in Congress assembled,*
3 That the President shall resume immediately bilateral talks
4 with the Soviet Union for the purpose of negotiating a com-
5 prehensive treaty prohibiting—

6 (1) the testing, production, deployment, or use of
7 any space-based, air-based, or ground-based weapons
8 system which is designed to damage, destroy, or inter-
9 fere with the functioning of any spacecraft of any
10 nation; and

11 (2) the stationing in orbit around the Earth, on
12 any celestial body, or at any other location in outer
13 space of any weapon which has been designed to inflict
14 injury or cause any other form of damage on the
15 Earth, in the atmosphere, or on objects placed in
16 space.

17 Any such treaty shall establish a procedure for verifying com-
18 pliance with its terms.

19 SEC. 2. The President shall request that the United Na-
20 tions take the necessary steps to bring about multilateral ne-
21 gotiations aimed at an extension of article IV of the Outer
22 Space Treaty of 1967 to include a ban on all weapons based

- 1 in space for use against any target and all antisatellite weap-
- 2 ons regardless of where they are based.

[Excerpts from President Reagan's speech of March 23, 1982.]

EXCERPTS FROM THE PRESIDENT'S MARCH 23, 1982, ADDRESS ON DEFENSE SPENDING AND ABM DEVELOPMENT

If the Soviet Union will join with us in our effort to achieve major arms reduction we will have succeeded in stabilizing the nuclear balance. Nevertheless it will still be necessary to rely on the specter of retaliation—on mutual threat, and that is a sad commentary on the human condition.

Would it not be better to save lives than to avenge them? Are we not capable of demonstrating our peaceful intentions by applying all our abilities and our ingenuity to achieving a truly lasting stability? I think we are—indeed, we must!

After careful consultation with my advisers, including the Joint Chiefs of Staff, I believe there is a way. Let me share with you a vision of the future which offers hope. It is that we embark on a program to counter the awesome Soviet missile threat with measures that are defensive. Let us turn to the very strengths in technology that spawned our great industrial base and that have given us the quality of life we enjoy today.

Up until now we have increasingly based our strategy of deterrence upon the threat of retaliation. But what if free people could live secure in the knowledge that their security did not rest upon the threat of instant U.S. retaliation to deter a Soviet attack; that we could intercept and destroy strategic ballistic missiles before they reached our own soil or that of our allies?

A LONG EFFORT

I know this is a formidable technical task, one that may not be accomplished before the end of this century. Yet, current technology has attained a level of sophistication where it is reasonable for us to begin this effort. It will take years, probably decades, of effort on many fronts. There will be failures and setbacks just as there will be successes and breakthroughs. And as we proceed we must remain constant in preserving the nuclear deterrent and maintaining a solid capability for flexible response. But is it not worth every investment necessary to free the world from the threat of nuclear war? We know it is!

In the meantime, we will continue to pursue real reductions in nuclear arms, negotiating from a position of strength that can be insured only by modernizing our strategic forces. At the same time, we must take steps to reduce the risk of a conventional military conflict escalating to nuclear war by improving our nonnuclear capabilities. America does possess—now—the technologies to attain very significant improvements in the effectiveness of our conventional, nonnuclear forces. Proceeding boldly with these new technologies, we can significantly reduce any incentive that the Soviet Union may have to threaten attack against the United States or its allies.

AN IDENTITY OF INTERESTS

As we pursue our goal of defensive technologies, we recognize that our allies rely upon our strategic offensive power to deter attacks against them. Their vital interests and ours are inextricably linked—their safety and ours are one. And no change in technology can or will alter that reality. We must and shall continue to honor our commitments.

I clearly recognize that defensive systems have limitations and raise certain problems and ambiguities. If paired with offensive systems, they can be viewed as fostering an aggressive policy and no one wants that.

But with these considerations firmly in mind, I call upon the scientific community who gave us nuclear weapons to turn their great talents to the cause of mankind and world peace: to give us the means of rendering these nuclear weapons impotent and obsolete.

Tonight, consistent with our obligations under the ABM Treaty and recognizing the need for close consultation with our allies, I am taking an important first step. I am directing a comprehensive and intensive effort to define a long-term research and development program to begin to achieve our ultimate goal of eliminating the threat posed by strategic nuclear missiles. This could pave the way for arms control measures to eliminate the weapons themselves. We

seek neither military superiority nor political advantage. Our only purpose—one all people share—is to search for ways to reduce the danger of nuclear war.

My fellow Americans, tonight we are launching an effort which holds the purpose of changing the course of human history. There will be risks, and results take time. But with your support, I believe we can do it.

[Letter to Senator Pressler from former Secretary of State Dean Rusk, received after the conclusion of these hearings:]

THE UNIVERSITY OF GEORGIA,
SCHOOL OF LAW,
Athens, Ga., June 1, 1983.

Senator LARRY PRESSLER,
Senate Office Building,
Washington, D.C.

DEAR MR. CHAIRMAN: I was very pleased to learn that your Arms Control Subcommittee is holding hearings on the prospective move of the arms race into outer space. Despite my deep and serious concern over these issues, I have not asked to be heard by your Subcommittee because of the difficulties I have with travel these days.

I believe very strongly that it would be a tragedy for the arms race to move into outer space without a persistent, imaginative and thorough effort on the part of the United States and the Soviet Union to prevent such a development. Such negotiations would not be easy because they must, as you have pointed out elsewhere, deal of necessity with ground based weapons capable of attacking objects in space. Measure of verification would have to go beyond those which have been used thus far to deal with the Soviet ASAT and comparable American weapons.

A little background may be instructive. During the Eisenhower Administration we achieved what I would consider to be a remarkable step in "preventive diplomacy" through the conclusion of the Antarctic Treaty. Under that Treaty, a vast part of the world was removed from the arms race, reserved for scientific exploration and provided visitation arrangements to give assurance that the Treaty was fully effective. We have effective treaties prohibiting nuclear explosion in the atmosphere, under water and in outer space. We have prohibited by treaty the orbiting of nuclear weapons in space or their emplacement upon the deep sea beds. During the mid-60's, we thought we had gone a long way toward removing outer space from military competition in the outer space treaties which were concluded during that decade. Certain passive uses of outer space for military purposes, such as communications and satellite photography, were acknowledged as lawful. Satellite photography has been an important means of verifying compliance with arms limitation agreements.

When we look down the road to the possibility of the movement of active weapons into outer space, I find the prospect very foreboding. We must assume that the Soviets would be able to do whatever we can do in outer space and that there is no possibility of gaining any unilateral national advantage. More importantly, however, if one or both sides begin to approach feasible space weapons such as lasers or particle beams, we can be certain that there would be a frantic race on both sides to devise offensive weapons which could penetrate or evade such defenses.

I would anticipate, therefore, that we would find ourselves spending hundreds of billions of dollars without any significant change in the relative strategic position of those concerned. It seems almost insane to go down this road without a major effort to prevent an outer space arms race. After all, the simplest way to get rid of a missile is to walk up to it with a wrench and screwdriver and take it to pieces. I, myself, would like to see us and the Soviet Union go just as far in the elimination of nuclear weapons as the possibilities of verification would permit.

I should like to see my grandchildren look up into the vast universe and reflect with the psalmist that the heavens declare the glory of God—and not the folly of man.

Sincerely,

DEAN RUSK.

[The articles referred to follow:]

[From the Los Angeles Times, Jan. 6, 1983]

AVOIDING A CRIPPLING SPACE-WEAPONS RACE

(By Larry Pressler)

In 1969, at the time that the United States entered the strategic arms limitation talks (SALT), the Air Force was about to flight-test a dramatically new weapons technology. This new concept, multiple independently targeted reentry vehicles (MIRV), represented a breakthrough in that each ballistic missile would have the capability to attack several targets. Concerned senators asked that MIRVs be placed on the SALT agenda and that flight tests be canceled in the interim. The Nixon Administration rejected this advice in the belief that MIRVs would provide us with a significant military advantage that the Soviets would be hard pressed to match.

But the Soviets deployed MIRVs much sooner than expected, and now they are a principal cause of American strategic vulnerability.

Today, America is at a comparable juncture with regard to the development of space weapons, and the quest for short-term advantage may lead to similar long-term results. Unless there is a serious negotiating effort, anti-satellite (ASAT) weapons could prove to be the MIRVs of the 1980s.

In the early 1970s, the Soviets deployed an anti-satellite weapon that they have maintained and continued to test. Though this weapon has limited ability to attack large numbers of U.S. satellites, the absence of an American equivalent does make for a strategic imbalance. In the most recent test of this system in June, the ASAT was fired in coordination with launches of land-based and sea-based strategic weapons, a MIRVed SS-20 theater missile and anti-ballistic missile defenses. This demonstration led some analysts to conclude that the Kremlin views ASATs as an important element for waging nuclear war.

Should current trends in Soviet research continue, the threat to U.S. space interests will not come from ASATs alone. Moscow has an active laser- and particle-beam weapons-development effort that can be deployed in or directed at space. Though this program may not be completed for more than a decade, the Soviets are said to be at least five years ahead of us in the development of these death rays. Taken as a whole, the Soviets now spend three to five times as much as we do on militarizing space.

The United States must take defensive measures against these developments. To begin with, we can reduce risks by stocking backup systems that could be launched if our satellites are threatened. The space shuttle could help put replacement satellites rapidly into position.

Then, too, defense analysts may have wrongly weighed the current vulnerabilities of our space network by understating the weakness of our land-based satellite-control facilities. Given the small number of such locations in relation to the large number of satellites, it could be easier to neutralize our space network from the ground. The plan to add a space-control complex at Colorado Springs is a move in the right direction.

I have far less confidence in military countermeasures in space. Hardening satellites and/or providing them with the capability to maneuver away from an attacker would add significantly to satellite costs and reduce the payload directed at the satellites' primary mission—and it may not work. Countermeasures invite counter-countermeasures, and escape techniques are futile against beams traveling at the speed of light.

The most desirable remedy to the space-weapons threat is a ban on space weaponry. Arms-control talks aimed at this end have not received the attention that they deserve. The apparent successes on the ground of the yet-to-be flight-tested American ASAT are perhaps the chief cause of the neglect of arms control.

When our version of the ASAT was inaugurated, Washington's primary motive was to draw Moscow into talks aimed at dismantling the Soviet ASAT in exchange for cancellation of the American program. Three rounds of talks were held in 1978 and 1979, but were broken off after the Soviet invasion of Afghanistan, and the United States has made no effort to revive them. Strategic planners are reluctant to bargain away the American ASAT now that it appears that it will be significantly better than the Soviets' deployed weapon.

As in the case of MIRV development, the United States has sought short-run advantage. In the long run, the benefits will be meager. Given the current dynamics of the Soviet space-weapons development program, the failure to stop ASATs and other space weapons will surely produce new Soviet deployments. In this race, the United States has far more to lose because we will continue to depend on space systems more than the Soviets will. Oceans separate us from areas that are in our national interest to defend, whereas the Soviet Union is in the heart of Eurasia, meaning that, while land lines provide the Soviets with rapid communications to their military forces, the command and control of U.S. military units is best achieved via satellites. Also, the open nature of our society makes it much easier for the Soviets to monitor U.S. military programs without "overhead" reconnaissance than it is for us to monitor theirs.

Pursuing a space-weapons race makes little sense. We face major deficiencies in our existing force structure. Adding another dimension to the U.S.-Soviet competition would require spreading ourselves even thinner. Besides, avoiding war requires some degree of stability in military developments, and introducing a space-weapons race would undermine the delicate balance of terror as well as the predictability that defense officials require for effective force planning.

The United States has every reason to give space arms control a try. With our ability to quickly test and deploy the U.S. ASAT as a backdrop, the Soviets may now negotiate seriously. Should negotiations fail, we would retain our current space-weapons option.

[From the New York Times, Jan. 13, 1983]

BAR WEAPONS IN SPACE

(By Larry Pressler)

WASHINGTON.—The current scare over the possibility that a Soviet nuclear-powered satellite may crash to the Earth's surface highlights the need for a space arms-control agreement. But despite the dangers posed by the space-weapons race, there are few indications that the Administration seeks to resume antisatellite-weapons talks. As the tempo of weapons development quickens, time is running out for reaching a comprehensive space accord.

In the first talks on the control of antisatellite weapons, in 1978 and 1979, the United States was eager for an agreement but the Soviet Union dragged its feet. No progress was made, and plans for continued talks were canceled in the wake of the invasion of Afghanistan. Today, Moscow seems eager to go back to the negotiating table—it has even presented a draft treaty to the United Nations—but the Administration was shown no interest in resuming talks.

Moscow's eagerness—and our reluctance—are best explained by the state of space-weapons technology. The Soviet Union had a head start in developing anti-satellite weapons—its first was an SS-9 missile joined to a satellite interceptor. The Carter Administration followed with plans for an American "satellite killer" that it could use as a bargaining chip in negotiations with Moscow. But the Soviet Union was not impressed by an American antisatellite weapon that existed only on the drawing board, and did not dismantle its decade-old system.

We proceeded to develop our own antisatellite weapons, and the major American lead in micro-electronics and systems miniaturization has made for high confidence in Washington. Some analysts believe that our weapon, which joins an F-15 aircraft to a rocket and interceptor, would be able to knock out more than 100 Soviet satellites in a day. With the development of this weapon, we will effectively surpass the Soviet Union, capturing the military high ground in space.

But in their enthusiasm to win this space contest, officials have seemingly forgotten the primary goal of the antisatellite-weapons program—an inducement to arms control.

It is unlikely that the Soviet Union will stand still in its development of space weapons, and any advantage we obtain in space will be short-lived—particularly when the Soviet Union is willing to spend three to five times as much as we do on space weapons. Keeping pace in the competition will be expensive, and trying to add yet another dimension to the United States' already diverse and financially needy military forces may mean doing many things badly rather than a few things well.

Besides, we, far more than Moscow, are dependent on risk-free operation in space. The Soviet Union's central geographic position and huge land area provide it with land lines of communication to much of the globe, while timely control of American forces worldwide depends largely on satellites. Already the potential risk of a space-weapons race has encouraged some defense planners to look toward costly and diplomatically delicate land-based communications as a backup. In any case, many military operations such as the attempted rescue of hostages in Iran would be nearly impossible without satellites.

Weapons that effectively threatened our satellites would also compromise other important military space missions such as early warning of strategic attacks, verification of arms control agreements and reconnaissance. We can of course "harden" our satellites to resist attack, add to antijamming equipment and equip them to maneuver away from the enemy's satellite killers. But this would greatly add to our defense bill and would interfere with our satellites' primary missions. The Pentagon has already requested that commercial satellites be hardened, perhaps making them uneconomical just when reduced cost has led to increased use.

This makes it all the more urgent to resume space-weapon negotiations. The United States should offer a nonrenewable two-year mutual freeze on flight tests of antisatellite weapons. If the Soviet Union resists this arrangement, we could begin with a ban on high-altitude antisatellite weapons tests. This would allow the United States to deploy its own antisatellite weapons in the short run and would protect many of our satellites. The restriction of antisatellite weapons testing is the first step—but the ultimate goal of negotiations should be a total ban on all weapons and hazardous objects in space.

[From the New York Times, Apr. 11, 1983]

WARNING: DANGER IN SPACE

(By Flora Lewis)

LONDON, April 10.—A small group of people, including some top experts on space war, just finished a conference near here on the military use of space.

Their chilling conclusion was that the military space age has already arrived and it can't be revoked. The questions remaining are whether there will be weapons in space and war in space. Even more chilling is the fact that they don't agree whether the possibility is good or bad for the United States.

There is, the experts said, remarkably little time left to make policy decisions that will lead America toward the "new high ground," as advocates call space in the military sense of seeking dominance, or away from it toward arms control.

The little-noticed establishment of an Air Force Space Command last year was more important than President Reagan's recent call to seek an antimissile weapon in space. It created an organizational base for those who want to challenge the Russians out yonder because they think there is a chance of breaking out of military balance to decisive superiority.

They argue, as Fred Iklé, Undersecretary of Defense, has put it, that this would move war "out there where the people aren't." They speak in terms of a more secure defense, but it is clear they think this would also reduce inhibitions on forceful pursuit of American interests on earth.

They don't discuss what wars are about or what they are supposed to solve. They seem to take it for granted that competition with the Russians is bound to bring conflict somewhere, so they suggest space not only because it's distant but because they believe the U.S. can permanently hold the lead.

Richard L. Garwin, who helped build the H-bomb and has worked for 32 years on exotic weapons and defense developments, warned a Senate committee against these beliefs last fall. "Space wars are not an alternative to war on earth," he said. "In my view, they are a prelude to war on earth." And he added that "we are on the verge of war in space" because of weapons the Soviet Union has tested and better ones the U.S. is preparing.

It is true that the space-based laser or electronic beam Mr. Reagan had in mind to shoot down earth-based nuclear missiles is 20 or 30 years away, if it ever proves feasible. But the risk of space war is no longer science fiction because of the development of antisatellite weapons, ASAT's in the jargon.

Studies of defense against missiles and attacks on satellites are conducted separately, but the links is inescapable. An antimissile space ray would have to

be stationed on a satellite, and it would only be as secure as that satellite's invulnerability to ASAT's, including the minuscule "space mines" that Mr. Garwin's fertile brain has envisaged in quite practical terms.

Work on ASAT's is forging ahead now in both the U.S.S.R. and the U.S. Space is already militarized, not with weapons yet, but with surveillance, communications and guidance systems that warn of a potential enemy's activity in peace and direct earthly weapons to precise targets in war.

"Sweeping the skies," as military planners call destruction or incapacitation of these satellites, would give the side that managed it such an advantage that the other side would probably consider it the first step to war and might well retaliate on earth. The U.S. is well ahead of the Russians in these satellite systems. That's a plus so long as they function, but also a weakness because the U.S. relies on them and could be struck dumb and blind if they were ruined.

Many kinds of countermeasures are possible, but it will also be possible to leapfrog them with new offensive devices. The story of MIRV's, the multiple-missile warheads that were supposed to put the U.S. far in the lead in the 1960's but spurred Soviet programs endangering the U.S. Minutemen now, is regularly cited by those experts who are convinced there isn't any kind of scientific wizardry to assure long-term U.S. superiority. On the contrary, the lesson of MIRV's is that another cycle in the arms race only assures soaring costs and greater risk of war.

Does that mean President Reagan's glint-in-the-eye vision of a defense against nuclear weapons must be totally rejected? Not necessarily. The history of weaponry is a swing between preponderance for defensive and offensive arms. But it does mean the effort must not be allowed to be a race and that the need for negotiated agreements is more urgent than ever.

The Russians proposed a treaty to ban certain kinds of ASAT's in 1981 after preliminary Soviet-American negotiations broke down because of the invasion of Afghanistan. None of the American experts find the draft acceptable as is, but those who wisely fear space war urge a counterproposal now.

A Senate bipartisan resolution asks the President to start talks again for "a verifiable ban on antisatellite weapons as a first step toward prohibiting all space-based and space-directed weapons." Anyone who realizes that war in the sky is far nearer than pie in the sky should urge the Senate to pass pending Resolution 43.

Senator PRESSLER. Senator Helms.

Senator HELMS. Thank you.

There has been no more gratifying development in the view of this Senator than the President's having put the subject of strategic defense at the top of the national agenda, or at least high on it. In my judgment it should always have been at the top because the very purpose of military force is to safeguard the American people.

Most Americans believe that the dollars they pay to the Pentagon go primarily to protect them against Soviet missiles. But in fact, for more than 15 years, in all candor the policy of the U.S. Government has been that the American people should be virtually without protection from Soviet missiles.

Since the McNamara days, we have relied upon the threat to massacre innocent Russian citizens for our safety. This is morally wrong, but it is not merely morally wrong, it is militarily senseless, especially since the Soviets have done and are doing everything in their power to protect the Soviet people.

Their missiles, unlike ours, are designed to destroy enemy silos, thereby dramatically reducing the enemy's ability to strike back, the enemy being us. After a Soviet first strike, the United States would be left with little more than half of our submarine-launched missiles. The ABM system around Moscow with rapid fire launchers, augmented by the battle management radars, would take its toll of our missiles. How many more would be struck down by dual-purpose air defense

systems is anyone's guess. Then of course, there is the old fashioned but effective Soviet air defense system.

The point I am making is that even our militarily and morally senseless retaliatory threat is losing credibility. As the Soviets develop directed energy defense weapons, the credibility of our offense will get close to the vanishing point.

So the question that we are going to discuss this afternoon is what are we going to do about it? Does anybody advocate trying to out-build the Soviets in counterforce warheads? I do not. I do strongly advocate trying to deny the Soviets the capability of disarming us and threatening us. In my judgment, the best way to do this is by ballistic missile defense. The best way to do that is by layering different systems. But the top layer must be space-based.

We have before us four distinguished citizens. They have varying views on this subject, which is good. We need to hear all views possible on this subject, and I certainly want to hear them.

I want to pay my respects in particular to my long-time friend, Danny Graham, who has done so much work in this area.

Thank you, Mr. Chairman.

Senator PRESSLER. Thank you very much.

Senator Pell, would you like to make your opening statement now or later?

Senator PELL. I think I will make my opening statement later on.

Senator PRESSLER. All right. Today we are fortunate to have a distinguished panel of public witnesses. They are Jan Lodal, executive vice president, American Management Systems, former member of the National Security Council staff; Dr. George Rathjens, professor of political science, MIT, former Deputy Director of DARPA; Lt. Gen. Daniel Graham, U.S. Army retired, director, High Frontier, and former head of DIA; and Dr. Daniel Deudney, senior researcher, Worldwatch Institute.

I have no preference for what order we call on them, perhaps in the order I read them, which happens to be the way they are listed here. Is that agreeable?

Therefore I will call first on Jan Lodal, executive vice president of American Management Systems.

**STATEMENT OF JAN M. LODAL, FORMER STAFF MEMBER,
NATIONAL SECURITY COUNCIL, ARLINGTON, VA.**

Mr. LODAL. Thank you, Mr. Chairman. In the interest of time I will highlight the points in my prepared statement and request it be inserted in the record, if that is acceptable to you.

I would like to touch today on three subjects. First, the desirability and feasibility of negotiating an agreement on ASAT weapons, as proposed in your resolution, Senate Resolution 43. Second, the relationship of such efforts to potential anti-ballistic-missile programs and the ABM Treaty. And third, the overall context of our ongoing arms control negotiations and the relationship of strategic arms limitations and intermediate nuclear force limitations to ASAT negotiations.

With respect to Senate Resolution 43, in principle, I fully support the effort to negotiate a ban on antisatellite weapons, and in the future,

a ban on further weapons in space, but I believe there are serious practical limitations to doing this.

As you know of course, we have several treaties that ban or limit certain types of weapons in space, and the ASAT treaty would go only one additional step in a long and continuous history of these efforts. But let me highlight a few of the difficulties that I believe our Nation will face if we attempt to—

Senator PRESSLER. Pardon me. I am sorry for interrupting. My colleagues have reminded me that I forgot to say that we are going to put a time limitation on opening statements of—what is a reasonable time for opening statements?

Senator PELL. Five minutes?

Senator PRESSLER. Keep it between 5 and 10 minutes, if you could. Then we can get into questions more quickly.

Mr. LODAL. Good.

Senator PRESSLER. And everybody's statements will be printed in the record in full, plus any additional materials you might have.

Mr. LODAL. Fine. The three difficulties that I would highlight are first, the importance of protecting our space-based system even if an ASAT treaty were negotiated. I don't see any way to negotiate a treaty that would effectively eliminate the Soviet capability to break out of the treaty and destroy our essential space-based systems, and therefore I believe we have to rely on military measures for this protection.

Second, we must be realistic in looking at the possibilities of ASAT treaties. I think there are serious limits to what can be done here. It is possible to in my opinion reach agreements that would eliminate all-out space wars, but I don't think we can go a long way beyond that in the near future.

Third, many of the verification aspects of ASAT are not only difficult, but essentially impossible. So we will have to negotiate agreements where we can rely on countermeasures and other military measures to protect us against the possibility of Soviet abrogation and breakout.

Fourth, the Soviets did not express much interest in this type of agreement in the past, so I don't think we would delude ourselves about the negotiating difficulties.

Now let me turn to ABMs. ABMs are certainly the most talked about and one of the most important possible space-based weapons systems, and therefore quite relevant to the recommendations in Senate Resolution 43. In my view, the issue with regard to ABM's is whether or not one ought to move away from the recommendations of a resolution such as this in order to permit more direct movement on an ABM.

My judgment is that a more direct movement toward an ABM would not be in the Nation's interest. I don't believe that such systems, including space-based ones, will be in our interest even if they could be made to work technically, and I think there are serious technical problems.

I might add here that in the 30 minutes we had ahead of time, General Graham was doing a very good job of convincing me that his system has more possibilities than perhaps the laser systems, and I

think that is worth hearing out. But nonetheless, I think there are serious problems and let me highlight just two or three of those.

The first is that you have to have essentially a perfect defense against bombers as well, unless you have a system such as this which is totally deployed in space. Otherwise, cruise missiles and bombers can come in ahead of time and simply destroy the ground-based elements of your ABM, leaving you defenseless.

The second is that you have a serious problem of a period of instability while you are trying to get these things deployed and the strategic relationship between the two sides. There is a period where there is great uncertainty, and there would be great risk.

The risk is that there is simply no way to protect the allies in Europe with these systems because the types of attack that you have to protect them against are not affected at all by any of these ABM systems, so you would have a tremendous political problem within the NATO Alliance. You can protect the American public, but you are not able to protect our European allies in any way.

So I think all of these are problems that have to be dealt with.

Finally, let me turn to the question of our broader arms control policy, because I believe this is absolutely important. I see absolutely no possibility of moving forward on ASAT treaties unless we are able first to put together some kind of a workable arms control regime that covers the most important weapons and the most important threats; namely the strategic retaliatory forces and the intermediate range nuclear forces of the two sides, the forces that are subject to negotiation today in Geneva.

I think this is an appropriate and important time to have these hearings because the Scowcroft Commission has just issued its report, which covers not only the MX but this broader issue of how our arms control policy should proceed.

In my opinion, they have made a major contribution in suggesting a movement away from past approaches and a movement toward aggregate limits on nuclear warheads. I would commend this report, the entire report, to your attention. I believe it is the most important statement on nuclear policy that has been made in a decade and deserves your attention.

I further believe that the present arms control approach that is being pursued, while no one can say for sure whether they will succeed or not, are unlikely to succeed. I think we would need to move to a different approach that does not have the complications associated with the START approach and the INF approach that today are under discussion in Geneva, and I think the aggregate warhead limit approach that the Scowcroft Commission has suggested is the right way to go.

In my prepared statement I have gone through some of the reasons for that and in some earlier writings have developed those thoughts even further. But I believe that if we could first reach an agreement that limited the total number of warheads in these important categories of intermediate and strategic forces, which by coincidence are essentially equal today in the Soviet Union and the United States, about 12,000 each, that we would then have an atmosphere in which important but in some sense secondary issues, such as ASAT, could proceed forward.

Thank you very much.

[Mr. Lodal's prepared statement follows:]

PREPARED STATEMENT OF JAN M. LODAL

I am pleased to appear before the committee today. By way of background, let me explain my involvement in the issues before you. For 2 years, from 1973 through 1975, I was a senior staff member and Director of Program Analysis for the National Security Council. In this capacity, I was responsible to Secretary Kissinger for staff work on arms control and defense program matters. I travelled with Secretary Kissinger on nine diplomatic trips, participated in three summit meetings with the Soviet leadership, and spent almost 200 hours in direct face-to-face negotiations with senior Soviet leaders, including Mr. Brezhnev, Mr. Gromyko, Mr. Dobrynin, and other senior officials. Since that time, I have written numerous articles on the subjects of arms control and defense policy. I maintain an active interest in these matters and continue to participate in panels sponsored by organizations such as The Council on Foreign Relations and the Carnegie Endowment for International Peace.

I would like to cover three subjects in my statement:

The desirability and feasibility of negotiating an agreement on ASAT weapons as proposed in Senate Resolution 43.

The relationship of such efforts to potential anti-ballistic missile programs and the ABM Treaty.

The overall context of our ongoing arms control negotiations and the relationship of strategic arms limitations and intermediate nuclear force limitations to ASAT negotiations.

SENATE RESOLUTION 43

In principle, I fully support efforts to negotiate both a ban on anti-satellite weapons and, in the future, a ban on further weapons in space. Keeping war out of space has always been an objective of U.S. arms control policy. The Limited Test Ban Treaty of 1963 banned nuclear explosions in space. The Outer Space Treaty later banned weapons of mass destruction in space. The ABM Treaty of 1973 banned deployment of space-based ABMs. The negotiations proposed by Senate Resolution 43 would be only one additional step in the long and continuous history of these efforts.

At the same time, I would reemphasize some of the difficulties our nation will face as we attempt to reach such agreements. You have heard most of these points from witness who appeared last September, but I will highlight a few:

First, I would reiterate the importance of protecting our space-based systems, even if a treaty can be negotiated. We must take adequate countermeasures and maintain backup for essential systems in any case. It would be impossible to negotiate a treaty that effectively prohibited a Soviet breakout, after which they would quickly threaten, at least on a small scale, many of our crucial space-based reconnaissance and control systems. We must never put ourselves in a position of relying exclusively on Soviet agreement and good will to preserve these essential capabilities.

A corollary to my first point is that we must be realistic in our expectations for such treaties. There are limits to what we can achieve. We can eliminate the most severe threats to our space systems and the possibility of all-out space wars. While the Soviets could break out of a treaty with some type of anti-satellite system, they would not be able to deploy large-scale anti-satellite systems rapidly enough to carry out full-scale space war. Eliminating this possibility would be no mean feat—it would contribute to the stability of a strategic balance and much improve the opportunities for maintaining workable diplomatic relationships with the Eastern bloc.

Many aspects of verification associated with such treaties will not only be difficult, they will be impossible. In such cases, we must be prepared to maintain countermeasures that will ensure our security and not in any way depend upon any treaty agreements we might reach.

The Soviets have not expressed very much interest in these types of agreements, so we should not deceive ourselves about the likelihood of achieving them.

In summary, it is my view that the type of agreements urged by the Resolution are desirable and worth pursuing, but the road to achieving them will be difficult. We should not expect this process to lead to any near-term lessening of the need for adequate military programs to protect and deploy our necessary space-based systems.

ANTI-BALLISTIC MISSILE SYSTEMS

The Resolution calls for an ASAT Treaty as a first step toward prohibiting all space-based weaponry. Perhaps the largest potential for space-based weaponry is that of anti-ballistic missile systems. As you are well aware, President Reagan has recently called for an increased effort to develop such systems.

Both the development and the deployment of space-based ABMs are currently prohibited by the ABM Treaty of 1972. But President Reagan's proposal obviously reopens the question of whether this type of treaty is in the Nation's interest.

In my view, these systems are not in the nation's interest. The development and deployment of such ABM systems by either side would intensify nuclear dangers rather than diminish them. I believe this is true even if the very serious technical problems associated with the development of such systems could be overcome. I do not want to belittle these technical problems—they are immense. Space-based laser systems, for example, would have to improve by about a factor of 1,000 over the present performance when the three major components are considered (laser power, reflecting mirror size, and accuracy of aiming) for them to be effective. But even if these problems could be overcome, these systems should not be deployed.

To begin with, it makes no sense to defend against anti-ballistic missiles unless one can also defend against bombers and cruise missiles. Some Administration spokesmen have argued that nuclear defenses need not be perfect to be useful. But the problem is that a leaky defense, in other words, one that is not perfect, allows the first few weapons through the defense to destroy the defense itself, leaving you once again completely undefended. Thus, the reduction in damage is not proportional to the effectiveness of the defense.

More importantly, there is no way to avoid a serious destabilization of the strategic balance if such defenses are developed and deployed. Even if it were possible to deploy near-perfect defenses eventually (which it is not), the strategic balance would be highly unstable during the many-year process in which these defenses were being deployed and perfected. In other words, there is simply no way to get from here to there.

Finally, it is not possible to defend our allies against nuclear weapons, because the Soviets can attack Europe with numerous systems other than long-range ballistic missiles. Their short-range missiles, aircraft, and battlefield weapons would all be unaffected by any such defense. Thus, were we to deploy one, we would inevitably and irretrievably split the NATO alliance.

In conclusion, I see no reason why the future possibility of space-based ABMs should be permitted to impede movement toward the types of agreements urged by Senate Resolution 43.

START AND INF

I would like to turn now to the question of our Nation's overall arms control policy. I am of course in no position to say whether or not President Reagan's approach to START and INF can lead to workable agreements. But given the Soviet reactions to these proposals to date and the severe unilateral restructuring they would cause the Soviets to undertake of their nuclear forces, I doubt that agreements will be reached.

But there is an even more fundamental problem. We have allowed our arms control process to become so complicated that it has come near to collapsing under its own weight. It is ironic that this has occurred in an Administration which strongly criticized earlier arms control approaches because they tended to "drive" our weapons programs, rather than being a complement to programs we needed for our own security purposes.

The Scowcroft Commission report just issued this week, has, in my opinion, made a major contribution in suggesting a movement away from past approaches and toward aggregate limits on nuclear warheads. In my personal writings, I have long urged such a move. I believe the most productive approach would be to negotiate a simple aggregate limit on all nuclear weapons carried by systems with ranges greater than 1,000 kilometers. By a coincidence of timing, the United States and the Soviet Union currently have approximately the same number of such weapons—about 12,000 each. This limit would include all of the forces under discussion currently in Geneva, plus other important forces not covered by either of these talks such as Backfire bombers and cruise missiles. The approach would have many advantages. It would eliminate the definitional

arguments that have plagued all past and current arms control negotiations—is the Backfire long range or intermediate range? Do Soviet SS-20s in Asia count or not? (There are many similar disagreements.) Within overall warhead limits, each side would be permitted to structure its forces as it saw best to meet its own security needs. It is difficult enough for us to make our own decisions on what forces we should have, much less to negotiate the details of our force program simultaneously with the Soviet Union.

An aggregate warhead limit would focus on the major problem, rather than allowing attention to be diverted to less important problems such as SS-20s taken in isolation, or Pershing IIs taken in isolation. The agreement I have proposed would freeze the total number of nuclear weapons of intermediate and long range. This would represent a major change in the psychology of the arms race. In the future, any new weapons deployed by either side would be accompanied by the destruction of an existing weapon.

I have covered these points in my testimony today for two reasons—first because the Scowcroft Commission report is the most important statement on nuclear policy in a decade or more and deserves your immediate attention, and second because I do not see any possibility of moving forward on secondary arms control agreements such as those urged by the Resolution you are now considering if we are unable to establish an effective and durable arms control regime on the major weapons systems held by the two sides. Thus, I would recommend that your Resolution be modified to endorse the arms control recommendations contained in the Scowcroft Commission report and urge that the Administration move rapidly to adopt them so that the build-up in nuclear weapons could be frozen, a stable agreement reached with the Soviets, and work begun on other issues of supreme importance to the two sides, such as weapons in space.

Again, thank you for the opportunity to testify before you today.

Senator HELMS [presiding]. I have forgotten the order that Senator Pressler specified. Dr. Rathjens, I am told by staff that you are No. 2, so we recognize you and thank you for being here, sir.

[Mr. Rathjen's biographical data follows:]

BIOGRAPHICAL DATA OF GEORGE RATHJENS

Dr. Rathjens received Bachelor's and Ph. D. degrees in chemistry from Yale University and the University of California (Berkeley) respectively, and later did post-doctoral work in spectroscopy. He was Chief Scientist and then Deputy Director of the Advanced Research Projects Agency of the Department of Defense (1960-62); was in the United States Arms Control and Disarmament Agency (1962-65); and was Director of the Systems Evaluation Division of the Institute for Defense Analyses (1965-68). Since then, he has been Professor of Political Science at the Massachusetts Institute of Technology. He is a fellow of the American Academy of Arts and Sciences; a member of the International Institute for Strategic Studies; a member of the Council on Foreign Relations; a sponsor, councillor and past chairman of the Federation of American Scientists; and is chairman of the Council for a Livable World.

STATEMENT OF GEORGE RATHJENS, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, FORMER DEPUTY DIRECTOR, DEFENSE ADVANCED RESEARCH PROJECTS AGENCY, WEST NEWTON, MASS.

Mr. RATHJENS. Thank you, Senator. I shall skip over parts of my statement. Let me begin with a brief comment on the importance of the military use of space.

Years ago, President Johnson noted that the intelligence information obtained from photosatellites alone had been worth more to us than the cost of our whole space program, and I agree with that. Without such information and that from electronic intercepts as well, we would have had to hedge against uncertainties in Soviet military capabilities by greater efforts ourselves, particularly in the strategic

arms area. We would have done this, but our efforts would have likely led to greater expenditures on their part, and so on. Thus, the arms race would have been much worse without that kind of information.

Moreover, important arms control agreements, such as the Limited Test Ban Treaty and the SALT agreements, would not have been possible, considering the difficulties without satellites of verification of compliance. And without satellites, we would have had to live in a world with more expensive, less adequate military communications systems.

Clearly, we have benefited from these uses of space much more than have the Soviets. This is because theirs is a closed society, making it hard for us to obtain information by other means, and because in respect to communications, they can rely more on internal means, whereas we, being the leaders of a global alliance with worldwide commitments, have much greater need for intercontinental capabilities.

In wartime, too, we will be more dependent on satellites than they will, and that dependence will very likely increase.

This brings me to the ASAT problem. If all we had to worry about was a system of such limited capabilities as that tested by the Soviets, I would not be much concerned. The prospects, however, are more ominous. The destruction or blinding of satellites is likely to be relatively easy. Their locations will be known to an adversary. They are inherently quite vulnerable, considering the kinds of sensors or communications equipment they carry, and many are so expensive that it is unlikely that great redundancy will be affordable.

Cost-effectiveness considerations suggest, then, that an action-reaction kind of a competition is a very realistic possibility. As one side develops an ASAT capability, the other will, within limits, deploy redundant satellites, take measure that will make its satellites less vulnerable, and develop decoys and other countermeasures.

Moreover, if either acquires any significant ASAT capability, or even threatens to, the other will develop not only countermeasures, but an ASAT capability of its own. Then, its adversary step will develop a better system, and so on.

In the development in the United States of the F-15-based system, which is incidentally, I think, a much more promising and flexible system than that of the Soviets, the competition is already well underway.

There is another side to the story, too. Suppose that ASAT capabilities turn out to be effective enough so that notwithstanding countermeasures, they can actually destroy a number of satellites in war. Such destruction could result in drastic erosion in intelligence and command, control and communication capabilities. This could make it difficult for the leadership of either country to make intelligent decisions, to communicate them to field commanders, and to communicate with the leadership of the other side so as to try to bring about a cessation of hostilities. And the destruction of satellites in the early stages of conflict could lead to rapid and catastrophic escalation.

These considerations lead me to believe that an agreement not to interfere with satellites would be in the interest of both the United States and the Soviet Union, more in ours than in theirs. S. Res. 43

would be consistent with this view and I would support it because of the desirable effects in limiting the arms competition and in dealing with crises and actual conflict, should we get into war.

Let me turn now to the question of ballistic missile defense. It is fundamentally a much more difficult problem than that of destroying satellites, especially if in considering destruction of ballistic missiles, one has in mind, as the President suggested, a 100-percent effective defense. The technical problems have by now been widely noted and I shall simply mention some without much discussion.

Perhaps the first point to make is that destruction of adversary reentry vehicles or boosters is not the only—indeed, not even the major—problem in ballistic missile defense. More fundamental is deciding what to attack and being able to cope with a very large number of objects at the same time.

Lasers or particle beams offer no apparent advantage in this respect, and as means for destroying targets are in some respects inferior to projectiles carrying explosive warheads. The latter can be effective even if they miss their targets by some distance; quite a large distance if they carry nuclear warheads. In contrast with the laser or particle beam, a miss by a millimeter is as bad as a miss by a mile.

Thus, with these exotic systems, there will be a requirement for extraordinary precision in pointing, the equivalent of being able to hit a grain of rice at a mile. And there is much that can be done to make the target difficult to destroy. Even if the laser or particle beam can be aimed with sufficient precision, the surface of a missile or reentry vehicle can be made reflective or ablative, and the warhead or missile can be made to rotate so that all of the energy of the beam will not have to be absorbed in one small area.

As many commentators have noted, one is confronted with the prospect of having a very expensive and complex system: one based on X-ray lasers driven by nuclear explosions, or one involving enormous mirrors and energy sources, if based on more conventional lasers. Not just one but dozens, possibly hundreds, of such space vehicles would be required to defend against even a single ballistic missile launch. This is because celestial mechanics dictate that any satellite will be in a position where it can engage a given target only a small fraction of the time.

Let me move on to my final remarks, if I may. I conclude that in sharp contrast to the situation with respect to ASATs, where dynamic competition is likely, in the case of ballistic missile defense, it is not less like 'Space-based ballistic missile defense is not sufficiently promisi- 2.

Yet, I am deeply troubled by the President's announcement. It suggests to me that he is ill-informed on military matters and perhaps out of touch with the scientific community.

My own view is that, notwithstanding his opinion and that of Secretary Weinberger, we had all better realize that security in the nuclear age is not to be found through technical fixes. Rather, to the extent we can have it at all, it must be largely through arms control, arms reduction, and the prudent resolution of political differences.

Thank you.

[Mr. Rathjens' prepared statement follows:]

PREPARED STATEMENT OF GEORGE RATHJENS

Mr. Chairman, Members of the Committee: I welcome the opportunity to appear before you to comment on the possibility of an extension of the Soviet-American arms competition into space. As I see it, there are four issues:

1. The importance of space-based military systems in peacetime.
2. The role of such systems during conflict, particularly between the United States and the Soviet Union.
3. The possibility and implications of interference with such systems through the development and use of anti-satellite weapons.
4. The question of space-based anti-ballistic missile systems.

I shall comment very briefly on the first two issues to set the stage for discussion of the third.

Years ago, President Johnson noted that the intelligence information obtained from photosatellites alone had been worth more to us than the cost of our whole space program. Without such information (and that from electronic intercepts as well) we would have had to hedge against uncertainties in Soviet military capabilities by greater efforts ourselves, particularly in the strategic arms area. This, we could have, and would have done, but our efforts would very likely have led to greater expenditures on their part, still more by us, and so on. Costly as it has been, the arms race would, then, have been worse without such information. Important arms control agreements such as the Limited Test Ban Treaty and the SALT agreements would also have been impossible, considering the difficulties, without satellites, of verification of compliance. And, without satellites, we would also have had to live with more expensive, less adequate military communications systems.

Clearly, we have benefitted from these uses of space much more than have the Soviets. This is because theirs is a closed society, making it hard for us to obtain information by means other than satellites; and because, in respect of communications, they can rely more on internal means, whereas we, being the leaders of a global alliance with world-wide commitments, have much greater need for intercontinental capabilities.

In war-time too, we will be more dependent than they on satellite capabilities; and with time, our dependence will almost certainly increase.

This brings me to the ASAT problem. As I am sure you are aware, the Soviets have had some success, but also a number of failures, with a very primitive anti-satellite system they have been testing. It will be extraordinarily limited in its capabilities, even if they improve it so that it can operate reliably, so if it were all that were in prospect with respect to ASAT systems, we would not have much to worry about. The prospects are, however, more ominous. Destruction or blinding of satellites is likely to be relatively easy: their locations will be known to the adversary; they are inherently quite vulnerable, considering the kinds of sensors or communications equipment they carry, and many are so expensive that it is unlikely that great redundancy will be affordable. Cost-effectiveness considerations suggest, then, that an action-reaction kind of competition is a very realistic possibility: as one side develops an ASAT capability the other will, within limits, deploy redundant satellites; it will make its satellites less vulnerable; and it will develop decoys and other countermeasures. Moreover, if either acquires any significant ASAT capability, or even threatens to, the other will develop not only countermeasures but an ASAT capability of its own. Then, the first side will develop a still better system, and so on. In the development by the United States of its F-15 based system—a system which incidentally promises to be much more flexible and effective than the Soviet system—the competition is well underway.

But there is still another side to the story. Suppose that ASAT capabilities turn out to be effective enough so that, notwithstanding countermeasures, they can actually destroy a number of satellites in war. Such destruction could result in a drastic erosion in intelligence and command, control and communication capabilities. This could make it difficult for the leadership of either country to make intelligent decisions, to communicate them to field commanders, and to communicate with the leadership of the other side so as to try to bring about a cessation of hostilities. And, destruction of satellites in the early stages of conflict could lead to its rapid, and likely catastrophic, escalation.

These considerations lead me to believe that an agreement not to interfere with satellites would be in the interest of both the United States and the

Soviet Union; more in ours than in theirs. We should get on with trying to secure such an agreement because of the desirable effect in both limiting the arms competition and in dealing with crises and actual conflict, should it occur.

Let me turn now to the question of ballistic missile defense, particularly to the possibility suggested by the President of developing defenses based on lasers or particle beams that might be so effective as to render nuclear weapons "impotent and obsolete." While he was not explicit in saying he had space-based systems in mind, I assume that that was the case inasmuch as there appears to be more promise in such systems than in those that might be based on the earth's surface and so would have to penetrate the atmosphere.

The problem of space-based ballistic missile defense is fundamentally very different from that of destroying satellites, especially if, in considering destruction of ballistic missiles, one has in mind, as the President suggested, a 100 percent effective defense. True, some of the same capabilities might be relevant to both problems, and agreements that limit or proscribe one kind of defense might apply to the other, but meeting the technical requirements for ballistic missile defense will be much more difficult than for the destruction of satellites.

Those technical problems have by now been widely noted, and I shall simply enumerate them without much discussion.

Perhaps the first point to make is that destruction of adversary reentry vehicles or boosters is not the only—indeed, not even the major—problem in ballistic missile defense. More fundamental is deciding what to attack and being able to cope with a very large number of objects at the same time. Lasers or particle beams offer no apparent advantage in this respect, and, as means for destroying targets are in some respects inferior to projectiles carrying explosive warheads. The latter can be effective even if they miss their targets by some distance—quite a large distance if they carry nuclear warheads. In contrast, with a laser or particle beam, a miss by a millimeter is as bad as a miss by a mile. Thus, with these exotic systems, there will be a requirement for extraordinary precision in pointing: the equivalent of being able to hit, say, a grain of rice or match stick at a mile. And, there is much that can be done to make the target difficult to destroy, even if the laser or particle beam can be aimed with sufficient precision. The surface of a missile or reentry vehicle can be made reflective or ablative, and the warhead or missile can be made to rotate so that all of the energy of the beam will not have to be absorbed in one small area.

As many commentators have noted, one is confronted with the prospect of having to have a very expensive and complex system, one based on X-ray lasers driven by nuclear explosions or one involving enormous mirrors and energy sources if based on more conventional lasers. Not just one but many—dozens, possibly hundreds—of such space vehicles would be required to defend against even a single ballistic missile launch. This is because celestial mechanics dictate that any satellite will be in a position where it can engage a given target only a small fraction of the time.

Even if it proves possible to deploy a system capable of destroying a missile or reentry vehicle at several hundred miles distance, there is the possibility of saturation of the defense with more targets—real or decoys—than it can handle; and with the high cost of the defense compared with the relatively low cost of ballistic missiles—much less, decoys—any offense-defense cost competition is likely to greatly favor the offense.

Then, there is the possibility of the defense itself being attacked by ASAT systems, e.g. the F-15 type, or by mines orbited in close proximity.

Finally, space-based laser or particle beam systems can be expected to be ineffective against aerodynamic vehicles: aircraft or cruise missiles of the kind now flying.

One has to conclude that even with very optimistic projections space-based laser or particle beam systems that might be deployed in the early part of the next century would not likely be very effective against capabilities now available, much less against those that might be developed by that time.

The President's announcement should not, then be seen as particularly significant because of any direct impact on military capabilities or on arms control prospects. We are not even likely to spend much money on such defenses—at least not much by Department of Defense standards—during the remainder of Mr. Reagan's tenure in office; and, this will be true, even should he be reelected. There is not much that can usefully be done. During that period—and for at least as far into the future as I can see—the military impact of moving in the direction outlined by the President will be small. The prospects are, indeed, so

poor that neither the U.S. nor the U.S.S.R. is likely even to feel much need during this time frame to improve its offenses to counter such a system.

All this is in sharp contrast to the situation with respect to ASATs, where a dynamic arms competition seems likely, and where there is the possibility of systems being deployed that could actually make a difference in the event of crises or conflict.

But notwithstanding these judgments, I found the President's announcement deeply troubling; perhaps, as much so as any that has come out of the White House during this Administration, or during the previous couple as well. It suggests that the President is ill-informed on military matters and out of touch with the scientific community of the country—or, perhaps even more troublesome, that if he is informed, he is willing to raise, for political purposes, an unrealistic hope that we can return to an earlier era in American history: to a Fortress America. While that might be comforting in the short term, to the uninformed it is surely misleading for Americans and it must be deeply troubling to those abroad who depend in some measure on us for their security.

Let me conclude by observing that, notwithstanding the optimism of the President and Secretary Weinberger, we had all better realize that security in the nuclear age is not to be found through technical fixes. Rather, to the extent it can be had, it must be largely through arms control, arms reduction and the prudent resolution of political differences.

Senator PRESSLER. Our chairman has arrived. Do you have an opening statement?

The CHAIRMAN. With the indulgence of my colleagues, I would very much like that opportunity. I regretfully have a few other commitments that have piled up because of our floor work.

I am first of all very appreciative of the ranking minority member and the second ranking member of the majority, the chairman of our Western Hemisphere Subcommittee, for being at this important hearing. I particularly commend you, Senator Pressler, for the really persistent efforts that you have made to focus more public attention and more attention of the U.S. Senate on the urgent problem posed by the growing militarization of space.

No Senator has ever been more conclusively and quickly proven true than to have a President of the United States give the speech that President Reagan gave, pointing out some of the potentials for the future and the necessity for doing some research work on it. As chairman of the Arms Control Subcommittee, you have shown leadership and initiative in addressing a particular threat raised by the imminent deployment of highly capable antisatellite weapons by both sides. Now, in the aftermath of President Reagan's speech calling for a full exploration of the antiballistic missile capabilities, I am very confident that you will be equally vigilant in leading the subcommittee's oversight of this proposal.

Today's hearing is a first step in this review and we are very pleased indeed to have such a distinguished panel. I understand that the administration was not prepared to come before the committee this afternoon to discuss the implementation of the President's proposal because the Defense Department and other agencies are only just now beginning to try to figure out what can be done, at what cost and on what kind of a timetable.

As a result, I look forward to another hearing to review the inter-agency recommendations, once their deliberations are complete. Until such time as we know exactly what the administration may be proposing in the way of new space or land-based ABMs and other strategic defensive systems, it would be premature to make a final judgment about the President's initiative.

Certainly there is little disagreement that the United States must maintain a vigorous research and development program in laser and beam weapons if we are to remain abreast of the massive Soviet investment in these areas. I have always maintained that we must keep abreast in research and development on ABM systems and other systems to know at least what could be used against us. We must stay in the forefront in those fields.

As one Senator who vigorously opposed the proposed ABM deployment—and deployment is an entirely different thing—in the late 1960's, I must say that I approach the question of actual deployments of new ABM weapons with considerable skepticism and reserve. I know at least one member of our distinguished panel who helped to counsel us when we struggled with this problem, the ABM, in the late 1960's. We were searching for the truth, and we reached deep into the scientific community to get all the guidance and help that we possibly could.

A majority of the Senate and a majority of this committee came to the conclusion, and certainly Senator Cooper was in the forefront of that effort at the time, that the ABM was not the right system to deploy. If we could mutually agree to not deploy, and it had to be a mutual agreement on both sides and be fully verifiable, we would be better off.

I don't know what the estimates are, but we would have spent about \$150 billion on that system to date. We would have spent billions each and every year to just maintain it and keep it up to date. But it would still have become obsolete.

I don't know of any decision that we have made that has been proven more accurate and right. I will couple that with saying we have to keep up our research and development constantly in this area.

I will not belabor my concerns at this time with the deployment problems of new ABM weapons. However, I would like to cite one point that was underscored in a hearing on space arms control which Senator Pressler chaired last September. In his prepared statement, Dr. Richard DeLauer, Under Secretary of Defense for Research and Engineering noted that in 1981 the Defense Department had reported to Congress on the conclusions it reached in its major review of space-based laser weapons. According to Dr. DeLauer, the Pentagon found that space-based lasers offered possible—and I repeat the word possible—military potential in a number of areas. But, and I quote now directly, "there are areas of major uncertainty in our ability to predict with confidence their ultimate utility." And that is a skeptical statement.

In light of these uncertainties, the Under Secretary testified that it would be 1987 at the earliest before "an informed decision" could be made on the prospects for going ahead with these weapons.

A few weeks ago, on the very day that President Reagan made his speech, DOD officials testified before the Armed Services Committee on space-based antimissile systems. In that hearing, Major General Lamberson, the Assistant to the Secretary of Defense for Directed Energy Programs, revealed that due to funding cuts, the Pentagon would not be in a position to make a decision on going forward with such systems until 1988.

To conclude, I would suggest that we are still years, if not a decade or more, away from knowing what might even be possible in the area of space-based ABMs. This leaves us time for careful review, and I am sure that you will play a leading role in keeping this committee, and your particular subcommittee, closely involved in studying whatever proposals might eventually be forthcoming.

I look forward to working with you, as all members of the committee do, in this endeavor and again commend you on your outstanding leadership in this particular area.

Senator PRESSLER. Senator Pell.

Senator PELL. Mr. Chairman, I too would like to join the chairman of our full committee in making my opening statement, and join him too in congratulating the chairman of the subcommittee. For a good many years I was chairman of the same subcommittee and know full well the scope of work and the responsibility that falls to the Subcommittee on Arms Control, Oceans, International Operations and Environment. We have a very wide mandate, indeed, practically the world.

The CHAIRMAN. Just three-fourths of the world and all of outer space.

Senator PELL. That is right, exactly.

The CHAIRMAN. But it is all under water on earth.

Senator PELL. Some of it is, 70 percent, but it ought to be treated like any of the other geographic bureaus, in the same serious approach.

It is more than a decade ago that as the United States and the Soviet Union were preparing to embark on a massive program to deploy MIRVs [multiple independently targetable reentry vehicles], that the Senate cautioned that such a step should not be taken. Unfortunately, the advice was ignored and the prohibition on MIRVs was never treated seriously in the SALT talks. As a result, we now face that problem of trying to control and reduce arsenals, including thousands of strategic nuclear warheads.

I remember personally being on the committee and arguing with the then administration about the lack of wisdom of moving ahead with MIRVs. We had an edge of 5 years over the Soviets at that time, but we knew they would catch up with us. So the question was raised: Why go ahead if we could ban those weapons or place strict limits on them?

And we are somewhat in the same situation now when it comes to outer space, and I hope we will not be blind to the threat that will be posed by an arms race in outer space. We should do all that we can on an urgent basis to achieve an agreement on antisatellite weapons, and also explore seriously and quickly the possibilities for prohibiting the costly and counterproductive development and deployment of weapons in space.

I am sorry in this regard that the executive branch is not prepared to discuss these issues in the hearing today. I would have thought they would have been, in view of the President's speech concerning outer space just a couple of weeks ago. I trust, however, that the administration will be present to provide witnesses at an early date. In the meantime, I join in welcoming the witnesses who are with us today.

Senator PRESSLER. Thank you.

We will now call on Lt. Gen. Daniel Graham, USA, Retired.

**STATEMENT OF LT. GEN. DANIEL O. GRAHAM, U.S. ARMY (RET.),
DIRECTOR, HIGH FRONTIER, WASHINGTON, D.C.**

General GRAHAM. Thank you, gentlemen. I really appreciate the opportunity to talk to you about this matter.

The first thing I would like to do is read you a letter from a young lady in San Diego, Calif. I wish Senator Cranston were here. She writes, and has nice handwriting, as a matter of fact. She says,

My name is Michelle Rico. I am nine years old. I heard my grandpa tell my Daddy that General Graham has figured out a way to stop Russian missiles from landing in our country and killing American boys and girls. If he could do that, then the Russians wouldn't shoot their missiles at us and you wouldn't have to shoot your missiles back at them and kill Russian boys and girls. Please, Mr. President, will you listen to what General Graham has to say. I don't want anybody killed. Please write to me. Your friend, Michelle Rico.

She says,

P.S. I have \$5 which I saved out of my Christmas money. I am going to send it to General Graham so he can tell everybody how the High Frontier can keep American boys and girls and Russian boys and girls from getting killed.

I wish sometimes that we would listen to what comes out of the mouths of babes because that little girl is right.

I believe it would be a tragedy indeed for the United States to follow the Soviet lead in banning all weapons in space. Two weeks after the first flight of the U.S. space shuttle Columbia, Premier Breshnev of the Soviet Union came forward with a public announcement that a treaty should be signed banning all military weapons in space.

From the Soviet point of view, this was a smart move, and indeed it was followed up later by the Soviet proposal for a U.N. treaty to that effect. It was good strategy for the Soviets because they recognize the fact that the United States had reached a position in space technology where the Soviet advantage in nuclear first strike capability residing in their superior force of long-range ballistic missiles could be nullified. The Soviets knew that the shuttle represented a transportation system to space over which the United States could move the men and material necessary to protect the free world from Soviet nuclear first strike or nuclear blackmail.

To follow the Soviet lead by banning all weapons in space, as opposed to banning nuclear weapons in space which has previously been agreed to, would be to deny to the United States our only chance to deliver ourselves and our posterity from the brooding menace of the balance of terror doctrines of mutual assured destruction. By putting into space a nonnuclear defensive system, we can deny to the Soviet Union any hope of an effective first strike with their huge intercontinental ballistic missiles.

A system such as that proposed by High Frontier would have no capability whatever of killing a single Russian, but could deny to the Soviet Union its first strike capability, not an effective retaliatory capability. Such a system could be deployed quickly and at reasonable cost if we use the technology currently available to us, already paid for by the taxpayers.

Once in place, we can discard the awesome doctrine of mutual assured destruction and base our deterrence on a new strategy of assured survival. As President Reagan has said, we will then be able to save lives, rather than merely threaten to avenge them.

The historic opportunity will surely be lost if the Senate of the United States persuades the Government to adopt the policy of banning even such patently defensive nonnuclear systems in space. Indeed, such a policy will perpetuate the mutual assured destruction doctrine and force us for the foreseeable future to live as hostages in the balance of terror strategic situation in which we find ourselves today.

For those who are most interested in arms control, I should point out that our arms control negotiations to date have been based on the attempt to maintain a balance within the balance of terror. If indeed we go to space-borne defense, it is perfectly logical to approach the Soviet Union this way to say Ivan, you have said that you do not wish to first strike the United States. You will excuse us if we worry about that since many of your weapons systems seem to be designed to do just that.

We are therefore going to put into space a defensive system which will deny any country the capability of first-striking the United States with nuclear ballistic missiles. Since you have no intention of doing that, you won't mind, of course, will you?

Further, you may not believe the United States when we say we have no intention of first-striking the Soviet Union. But if you Soviets don't believe us, then we invite you to put a similar system in space yourself.

This kind of arms control effort may have some chance of success. And it certainly in my view would have more chance of success than the efforts we have conducted thus far to try to maintain a balance in the balance of terror.

I should point out that the High Frontier system that I have spoken of does not employ lasers and does not employ particle beam weapons or any futuristic Buck Rogers system. In fact, High Frontier uses kinetic energy kill; that is, a kill of the Soviet weapons with pellets, like buckshot.

If you worry that this is not technically feasible, I would like to call your attention and the attention of your staffs to a document recently declassified by the Department of Defense which was Project Defender. In Project Defender, in 1962, 20 of the best scientists within the Department of Defense, backed by a staff of 5,000 technicians and administrative personnel, came to the conclusion that a defense such as High Frontier's could have been deployed by 1968.

So we are not talking Buck Rogers when we back the President's call for a defense in space. We do not have to have lasers or particle beam weapons, although High Frontier has no objections to such weapons and a second generation may include them. The fact of the matter is that within 5 or 6 years, at a cost not of many billions but of \$15 billion, a strategic defense can be had by this country. If President Reagan runs again, he may see a space-borne defense against the long-range Soviet ballistic missiles during the period of his Presidency.

Now we have had contests that what we say will cost much more. As a matter of fact, we had correspondence from Mr. Carlucci, the Deputy Secretary of Defense, who said that we were wrong, that in fact it would cost \$50 billion.

Well, we don't agree with Mr. Carlucci or the Department of Defense. We think it will cost far less. But even if it did cost \$50 billion, this is less than it would have cost us to deploy the MX in Jimmy

Carter's racetrack deployment scheme for MX. And all that would have done is to add 200 more missiles to our inventory.

So we say that we propose a strategic bargain. Even if our detractors' figures for how much it cost are correct—we do not believe that, but even if they are correct, we offer this country not just a strategic bargain. We offer to this country once again what the country should be able to expect from its government, which is protection against the worst threat that the United States of America has ever faced, and that is the threat of destruction within 35 minutes of a Soviet decision to fire its long-range ballistic missiles.

That this is technically feasible was proved 20 years ago. All that is required today is the political will to do so. But also required is a realization that this new arena of human activity called space must be used to its utmost by the United States for the defense of this country and of its allies and for the promotion of industry in space and this should be done as quickly as technology will allow.

Thank you.

Senator PRESSLER. Thank you. We will now call upon Dr. Daniel Deudney, senior researcher, Worldwatch Institute. You have 10 minutes.

[Mr. Deudney's biographical data follows:]

BIOGRAPHICAL DATA OF DANIEL DEUDNEY

Daniel Deudney is a Senior Researcher at the Worldwatch Institute and author of *Space: The High Frontier in Perspective*, as well as numerous articles on space war, the peaceful use of outer space and alternative security systems. Mr. Deudney holds a B.A. degree in Political Science and Philosophy and has studied science, technology and public policy, with an emphasis on space, at the George Washington University. Mr. Deudney is also the co-author (with Christopher Flavin) of *Renewable Energy: The Power to Choose* (W. W. Norton, 1983) and is at work on a new study, *Whole Earth Security: A Geopolitics of Peace*. He is also co-chairman of The Institute for Security in Cooperation in Outer Space (ISCOS), a new public interest research organization group devoted to exploring alternative space-based security systems.

STATEMENT OF DANIEL DEUDNEY, SENIOR RESEARCHER, WORLDWATCH INSTITUTE, WASHINGTON, D.C.

Mr. DEUDNEY. Thank you. Buffeted by MAD [mutually assured destruction] men telling him to perpetually assure our destruction and NUTS [nuclear utilization theorists] telling him to prepare to fight nuclear wars, President Reagan looked to the heavens in the hope of finding salvation.

He looked in the right direction. Space technology can be the cornerstone of an alternative security system that does not rely upon ever-more massive nuclear arsenals. We must avoid using space as another arena of competition, and instead use it as a medium for mutual benefit to build a system of mutual assured survival.

Space technology is not new to the arms race. Ballistic missiles use outer space as a corridor for high speed attack. Reconnaissance satellites are used to monitor the superpowers' military machines. And over the last decade the trend toward fighting nuclear wars is rooted in satellite force multipliers, such as geodetic communication and navigation satellites.

The present effort to upgrade surveillance satellites by giving them real time data links through relay satellites will turn this important arms control monitoring system into a war-fighting system. Unfortunately, regulating these war-fighting information services without constraining civilian and verification technologies is impossible. Therefore, this makes all the more important early agreements limiting long-range ballistic missiles.

We are today at a major turning point in outer space military use, the beginning of a race to put weapons in space. The first antisatellite weapon, an ASAT using nuclear weapons, was tested and deployed by the United States and then dismantled. A second ASAT, an orbital rendezvous system tested by the Soviet Union, cannot reach most U.S. military satellites, is launched from a large, distinctly configured Soviet rocket requiring extensive support facilities, and provides plenty of warning time.

The third leg is about to begin as the United States tests an air-launched, direct ascent system that will destroy through high-speed collision. This system will be capable of striking a high percentage of Soviet satellites, is small and difficult to distinguish from other air-launched missiles, and will give little warning of attack.

If history is any guide, the next move in this game of leapfrog will probably be a Soviet laser battle station. It will probably not be very effective. It will have the effect in the United States of psychological panic, such as we had with Sputnik, and the result will probably be a large-scale space arms race.

What would these weapons be for and how will they affect our security? ASATs will be an important part of a first strike strategy against early warning satellites. Far less plausible is their use in an extended nuclear war. ASATs will, however, increase the chances for accidental nuclear war by putting into jeopardy the various surveillance and early warning systems.

Predicting how the more elaborate systems will work is very difficult because there are so many unknowns. However, it does seem improbable that they will be capable of shooting down a full scale preplanned first strike. Far more likely is that they would be used as a component of a first strike to mop up those missiles which are not destroyed on the ground.

In other words, as with accurate ICBMs, the advantage in space war will go to the side which strikes first.

Space war will largely preclude the peaceful use of outer space. We think of space as infinitely vast, but in fact it is subject to many of the same crowding and resource problems we have on Earth. Space junk is already a growing problem and further ASAT tests involving explosions or collisions will greatly add to this problem. Even testing the X-ray laser system proposed by Dr. Teller would damage important civilian satellites such as the more than 100 communication satellites that will be in geosynchronous by the end of this decade.

In a very real sense, we face an either-or choice: Science, information, and Earth monitoring from space or space war.

The present arms control regime in space, the test ban, ABM and outer space treaties have worked well, but they contain important loopholes. However, to abandon these treaties because of their loopholes would be like dynamiting a leaky dike at high flood rather than plugging the leaks.

Fortunately, we are at a stage where weapons in space can be stopped because they have not been extensively tested and deployed.

What would a treaty banning weapons in space look like? First of all, I do not think a treaty banning just antisatellite weapons and not space weapons generally is feasible. Trying to ban ASATs but not the more ambitious ABMs would be like outlawing handguns while permitting a race to develop bazookas and machineguns.

To effectively outlaw weapons, a treaty should outlaw specific, clearly defined activities. I would include the following: explosions, unmanned orbital rendezvous, collisions and high speed passes, close approaches, as well as limitations on the size of laser mirrors, the size of atomic power sources, and where possible, electromagnetic interference. By banning these types of activities, I think we could effectively prevent weapons in space.

There are also two law of space issues that need immediate attention: space traffic control and the boundary between national air space and international outer space. With thousands of objects whizzing around the world, traffic control, debris minimization and prenotification measures need to be strengthened and adopted. Unless they are, nasty accidents are likely to occur.

By reducing the chances for accidental collisions, close passes and explosions, a space traffic control regime would further strengthen comprehensive weapon test bans. The precedents for such a system are the various regimes to monitor and control air lanes over the oceans.

The outer space treaty also needs extension in the area of the boundary between outer space and national air space. Thus far, the absence of an agreed-upon upper limit to national air space has been rather academic because the highest flying aircraft goes only as high as 110,000 feet, while the lowest flying satellites pass at 400,000, leaving a convenient buffer zone. This no man's land will, however, soon disappear as aerospace planes, such as the shuttle and the proposed space cruiser, begin to operate both in space and the atmosphere.

Rather than wake up to another U-2 affair or a Soviet campaign to close the open skies by dramatically raising the boundary of national air space, the United States should attempt, as part of a comprehensive package, to enshrine as low a boundary as possible.

The observations on the need for a comprehensive treaty should not detract from the fundamental sense of urgency about ASATs controls now. Since treaty drafting will take time, the best course is for the United States and the Soviet Union to agree to an informal ban on further ASAT tests until a treaty can be negotiated.

The control of weapons in space simply clears the stage for the use of space technology to improve arms control verification and to improve our relations with the Soviets. There are three important aspects of this positive space regime.

First of all, we should expand the use of space for crisis monitoring. Particularly, we should establish an orbital joint command center between the United States and the Soviet Union to reduce the chances that an accident, a miscalculation, or a false alarm with our many nuclear forces will lead to war.

Second, we should establish an international satellite monitoring agency. Such an organization would permit the Security Council to monitor crises, and border disputes, and most importantly, lay the groundwork for monitoring compliance with the various multilateral

treaties. It is particularly ironic that the United States, with its great concern for verification, has so vigorously opposed expanding access to this important peacekeeping technology.

Third, we should have joint missions with the Soviet Union, both unmanned and manned. A U.S. administration looking for a bold, high visibility, quick payoff effort to improve relations with the Soviets, would, I think, embrace the idea of joint manned missions. What better way to find out what is going on in the Soviet space stations or to allay Soviet fears about the shuttle than to take each other for a ride? More routine cooperation would also make difficult concealed weapons work.

In conclusion, the world is now at a critical juncture. Either we move now to comprehensively ban weapons in space or we will have a major arms race on our hands. Instead, we should use space technology to build an alternative security system.

Thank you.

[Mr. Deudney's prepared statement follows:]

PREPARED STATEMENT OF DANIEL DEUDNEY

"We have no adequate idea of the predisposing power which an immense series of preparations for war has in actually begetting war."

WILLIAM GLADSTONE.

"The only defense against the weapons of the future is to prevent them ever being used. In other words, the problem is political and not military at all. A country's armed forces can no longer defend it; the most they can promise is the destruction of the attacker . . .

Upon us, the heirs to all the past and the trustees of a future which our folly can slay before its birth, lies a responsibility no age has ever known. If we fail in our generation, those who come after us may be too few to rebuild the world, when the dust of the cities has descended, and the radiation of the rocks has died away."

—ARTHUR C. CLARK.

Buffeted by the MAD (mutually assured destruction) men telling him to perpetually assure our destruction and the NUTS (nuclear utilization theorists) telling him to prepare to fight nuclear wars, President Reagan looked to the heavens in hope of finding salvation from our deepening peril.

He looked in the right direction. Space technology can be the cornerstone of an alternative security system, the foundation of an international order that does not rely upon evermore massive arsenals of nuclear weapons.

If we can avoid using space as another arena for conflict and instead use it as a medium for mutual benefit, we will have taken a giant step toward enduring peace.

Space technology is at the core of the present superpower standoff. The first military space technology, ballistic missiles, used space as a corridor for high speed unobstructable attack, thus enabling the Soviets to outflank American dominance of air power and directly threaten the United States. The second use of space technology for military purposes, reconnaissance satellites, enabled the United States to roll back the veil of Soviet secrecy and monitor in detail the Soviet military machine.

The ominous movement over the last decade toward fighting a nuclear war is in large part the consequence of the satellite "force multipliers": geodetic satellites to improve the accuracy of missiles; communication satellites to coordinate strikes or retaliation; and navigation satellites (such as NAVSTAR GPS) to make submarine launched missiles as accurate as land-based ones. The present effort to upgrade U.S. surveillance satellites by giving them "real time" data links through relay satellites will turn an arms control monitoring system into a war-fighter for targeting mobile forces and performing postattack damage assessment. (For example, the "civilian" TDRSS relay satellite launched by Challenger last week will help do this for the successor to the KH-11 reconnaissance craft, the RM-6 scheduled for 1986 launch.)

Regulating these war-fighting information services without constraining important civilian and arms control verification treaties would be difficult, if not impossible. This makes it all the more imperative that agreements limiting long-range ballistic missiles be signed in the near future.

We are now at a major turning point in the military use of outer space—the beginning of a race to put weapons into space.

The first antisatellite weapon, ASAT, an American system, employing nuclear warheads, was tested and deployed. It was dismantled because it was too indiscriminate in its destructiveness and, with the Limited Test Ban, could no longer be tested.

The second ASAT, a Soviet orbital rendezvous system using conventional explosives, has been tested some two dozen times with about a 50 percent rate of success. This system, which cannot reach most U.S. military satellites, is launched from a large, distinctly configured Soviet rocket requiring extensive support facilities, and providing plenty of warning time.

The United States is about to begin testing an air launched direct ascent system that will destroy through high speed collision. The U.S. system will be capable of striking a high percentage of Soviet military satellites, is small and hard to distinguish from other air launched missiles, and will give little warning time.

If history is any guide, the next move in this deadly game of leap-frog may well be a Soviet laser orbital battle station intended to cripple satellites. Given the Soviet tendency to deploy much earlier in the development cycle than the United States, and the immense technical problems associated with such a system, it will probably have negligible capability—except to reduce warning time. Like with Spatnik the psychological impact will probably be traumatic, leading the United States to embark upon an ambitious crash program to put battle stations into orbit. The result will be a full scale arms race in space.

What are these weapons for and what strategic purpose will they accomplish? How will our security be effected?

The antisatellite capabilities will be important components of a first strike against early warning satellites. Far less plausible is their use in a protracted nuclear war—their official justification.

ASATs will, however, increase the chances for accidental nuclear war. The eyes and central nervous system of our already highly strung nuclear strike forces are in space. With weapons in space every satellite malfunction could be the harbinger of a surprise attack. The Archduke Francis Ferdinand of World War III may well be a critical United States or Soviet reconnaissance satellite hit by a piece of space junk in a crisis situation.

Predicting how the more speculative larger scale systems would be used hinges on many unknowables. But it seems improbable that they would be capable of stopping a full-scale pre-planned first strike. Far more plausible is their use as part of a first strike to "mop up" those missiles that escape destruction on the ground.

Large-scale space weapons would be an example of a destruction entrusted automatic device (DEAD). To work a space weapon could never be commanded and controlled by humans. A space laser, for example, would have about five minutes to detect, target and engage an ICBM in the boost phase. One Department of Defense analyst put it this way, "We would have to delegate the decision-making to the weapon system itself and we have had no experience in that type of operational system." To start a nuclear war in the MAD era would have required a major political misjudgment: with space weapons a machine malfunction would be sufficient.

Space war will also largely preclude the peaceful use of outer space. We rightly think of space as infinitely vast, but in doing so we forgot that the earth's orbital space is limited and subject to the same problems of crowding and resource degradation we face on earth. Already space junk—small bits of debris flying about in various odd orbits—is a growing problem. Further ASAT tests involving explosions and collisions will add greatly to this problem. Testing the X-ray laser system proposed by Dr. Teller would damage important civilian satellites with electro-magnetic pulse (EMP). By the late 1980s over 100 communication satellites in geosynchronous orbit, worth between five and ten billion dollars, will be in jeopardy. In a very real sense we face an either or choice: science, information services, and earth monitoring from space—or weapons in space.

The present arms control regime for space weapons—the Limited Test Ban Treaty, the ABM Treaty and the Outer Space Treaty has worked remarkably well, but contains important loopholes through which space weapons can pass.

To abandon these treaties because of their loopholes would be like dynamiting a leaky dike at high flood rather than plugging the leaks.

Fortunately, we are at a stage where weapons in space can be stopped before they are ever extensively tested and deployed. Space weapon development is no further along than air war was when World War I biplane reconnaissance pilots carried hand guns. Most importantly, because so little has been tested, truly comprehensive controls are relatively easy to construct and verify.

What would a verifiable treaty banning weapons on space look like? First, a treaty banning just anti-satellite weapons and not space weapons generally is not feasible. Trying to ban ASAT's but not more ambitious anti-ballistic missile systems would be like outlawing hand guns while permitting bazookas and machine guns.

Second, a treaty should contain both broad prohibitions and careful functional prohibitions. For broad language I would suggest prohibiting:

The testing, production, deployment, or use of any space-based, air-based, or ground-based weapons system that is designed to damage, destroy, or interfere with the functioning of any spacecraft of any nation; and

The stationing in orbit around the Earth, on any celestial body, or at any other location in outer space of any weapon that has been designed to inflict injury or cause any other form of damage on the Earth, in the atmosphere, or on objects placed in space.

To effectively outlaw weapons, a treaty should outlaw the following observable activities and capabilities (or Functionally Related Observable Differences "FRODs" in the language of SALT):

Forbid explosions and unmanned orbital rendezvous by two satellites of the same country. (This would ban the U.S.S.R.'s orbital rendezvous ASAT.)

Forbid collisions or close high speed passes. (This would ban U.S. direct ascent.)

Forbid close approaches in geosynchronous orbit. (This would ban space mines.)

Limit the size of laser mirrors and the number of maximum-size laser mirrors bundled together. (This would allow laser communications but forbid lasers capable of destroying satellites or missiles.)

Limit the size of atomic power sources. (This would effectively foreclose scale-up of directed energy weapons, slow the development of active radar targeting satellites, such as Cosmos 942 and 1307, and protect human health from fallout.)

Limit electro-magnetic interference. Present restrictions by the International Telecommunications Union (ITU) should be strengthened and included in an arms control agreement.

There are also two "Law of Space" issues that need attention: traffic control and the boundary between national air space and international outer space. There are now thousands of tracked objects whizzing about the earth and tens of thousands of smaller untracked ones. Unless traffic control, debris minimization and pre-notification measures are strengthened or adopted, nasty accidents are likely to occur. By reducing the chances of accidental collisions, close passes, and explosions, space traffic control will further strengthen comprehensive weapons test bans. The precedents for such a system are the agreements governing heavily used air lanes over the oceans.

The Outer Space Treaty does not define where space begins and nature provides no clear line of demarcation. As with the oceans, the edge of national territorial zones is fundamentally arbitrary—and terribly important. Thus far the absence of an agreed upon upper limit of national air space has been academic since the highest flying aircraft go only as high as 110,000 feet while the lowest satellite passes at 400,000 feet—leaving a convenient buffer zone. This "no man's land" will disappear as aerospace planes—such as the U.S. space shuttle or the proposed "space cruiser"—begin to operate in both orbital space and the atmosphere. Rather than wake up to another U-2 affair or a Soviet campaign to close the "open skies" by drastically raising the boundary of national space, the U.S. should attempt, as part of a comprehensive package, to enshrine as low a boundary as possible.

These observations on the need for a comprehensive treaty should not detract from the fundamental urgency to do something right away. Since treaty drafting will take time, the best course is for the United States and the Soviet Union to agree to an informal ban on further ASAT tests.

A NEW SPACE SECURITY AGENDA

The control of weapons in space simply clears the stage for the use of space technology to improve both arms control verification, and our relations with the Soviets. This positive space security agenda emphasizes the unique role of space technology in providing *mutual* assured security and mutual benefits.

First, expand the use of space for crisis monitoring. The recently proposed establishment of an orbital joint United States-Soviet command center should be a priority. When there are tens of thousands of nuclear weapons, many within minutes of their targets, on perpetual alert status and checked only by unmanned warning satellites and the hotline, it makes eminent sense to exploit "the high frontier" to keep a tighter lid on accident, miscalculation and false alarm.

Second, establish an International Satellite Monitoring Agency (ISMA). This idea, proposed by Giscard d'Estaing before the General Assembly in 1978, has been vetoed by United States and Soviet opposition. An ISMA would permit the Security Council to monitor crises and border disputes and would lay the groundwork for monitoring compliance with the treaties banning chemical and biological warfare and environmental modification. Depending on whether ISMA obtained technology from the superpowers, a basic monitoring system would cost between \$1 billion and \$2 billion a year—about the cost of one B-1 bomber. Such an international system would supplement, not substitute for, the national monitoring systems. It is particularly ironic that the United States with its great concern about verification of arms control treaties, has so vigorously opposed expanding access, and gaining international legitimacy for this critical peacekeeping technology.

Third, conduct joint missions with the Soviets.

Writing in 1976, Bruce Murray, former head of the Jet Propulsion Laboratory and President of the Planetary Society, observed, "The rate of progress in space science may well be dependent on the political fortunes of detente on earth." This greatest adventure of our time—the peaceful exploration of the cosmos faces a bleak future, declining budgets and preemption of technology by the military both here and in the Soviet Union. Having two separate space programs doing much the same things makes less and less sense. And as costs of missions rise, the need for cooperation grows still further. A series of joint planetary and scientific probes would be a boost both to our sagging programs—and political relations.

Joint manned missions would be even more valuable. A U.S. Administration, looking for a bold, high visibility, quick pay-off way to cut through gathering clouds of suspicion and war, would find a joint United States-Soviet manned space mission particularly appealing. Unlike in 1976 when the Apollo-Soyuz rendezvous was a meeting of two parallel systems, the space shuttle and the Salyut stations are perfect complements for each other. What better way to find out what's going on in Soviet space stations or to allay Soviet's suspicions about the shuttle than to take each other for a ride? More routine cooperation in space and the consequent co-mingling of space scientists would make much harder concealed weapons work.

In conclusion, the world is at a critical juncture. Either we move now to comprehensively ban weapons from space or we will have a major new arms race on our hands. Space technology can be the foundation of an alternative security system—if we ban weapons now.

The CHAIRMAN. Thank you very much. That does complete the testimony of each of you. I have a few questions.

Mr. Deudney, I would like to ask you, because you suggest in your testimony that the Soviet ASAT gives plenty of warning, first, what advantages does warning give when most satellites have only limited maneuver capability?

Mr. DEUDNEY. The warning time is important because it would not make possible the use of the ASAT as part of a first strike. And if it weren't used as a first strike, it is hard to see what it would be used for. Presumably, it would be used to shoot down the early warning satel-

lites, and it can't do that at this point because it is too low, and if it were ever able to, it would take a long time.

The CHAIRMAN. Also, reportedly the Soviet ASAT interceptor requires between one and three orbits for attack. Is this enough warning to take countermeasures?

Mr. DEUDNEY. It is enough warning to provide warning of an attack, and it would serve the same functions as our early warning satellites. It would be an unambiguous attack on a U.S. system.

It is important also to note that the Soviet ASAT has not yet been tested at the same high level where our early warning satellites are, so a test ban would freeze it at a point where it had never been tested against that type of system.

The CHAIRMAN. Thank you very much.

Mr. Lodal, you indicated in your statement that we should make significant progress first in arms reductions before we deploy a space-based ballistic missile defense. First, could you define what you would classify as significant arms reduction? What would be significant in this regard? Was SALT II significant, for instance, in your judgment?

Mr. LODAL. Senator, I think SALT II was significant. I believe a freeze at current levels, without any reductions of the warheads that are on the systems under discussion in Geneva today would be significant.

I don't want to leave the impression that as you reduce those numbers down by say 50 percent, the 12,000 weapons today to 6,000 weapons, that it would make the space-based ABM useful. I think it would make a space-based ABM or any ABM less necessary.

But I still don't think that the ABM would be a good idea. What I meant to suggest was that I think the best approach to the future to move the world to a position where there is less threat perceived by the populations of both our nations and our allies, and even the Soviet Union, is through arms control, not through the deployment of ABM's.

General GRAHAM. Could I add something to that, Senator?

The CHAIRMAN. Please, General.

General GRAHAM. You know, throughout history, various kinds of weapons have been thought to be ultimate weapons. Their reduction in numbers has been caused throughout history by technology making them less useful. That is the opportunity that is presented to this country today, that we can make the most awesome of strategic nuclear weapons, the long-range ballistic missile, less useful.

If we go in that direction, then the reduction of nuclear offensive systems is something that you can predict. They will be reduced, not because you have Mr. Andropov to sign the right piece of paper, but because his long-range missiles are of less value to him.

The CHAIRMAN. I wonder if we could go back to you, Mr. Lodal, and now that you have expanded somewhat on why we must have reduction before we deploy, is there anything further you would like to add as to why you came to the conclusion and what the interrelationship is?

Mr. LODAL. I would be happy to. I think the point that is missed in General Graham's statement and in the President's analysis is the overwhelming destructive power of offensive nuclear weapons. If we

reduced the world's nuclear arsenal by a factor of 100, we would still have nuclear arsenals left on both sides that could destroy all the major cities in the Soviet Union and the United States.

So I don't see any way that we could build defensive systems that are so airtight that they could protect against that type of destruction. In that situation I believe we have to rely upon deterrence and diplomacy to give us the safety that we have enjoyed for the last 40 years, and I believe that it is dangerous for us to believe that we can find a technological solution—and I am a technician and love to see these things. I look at General Graham's pictures in his book and they are marvelous. I even bought the book from him on the spot.

And I would certainly urge that we continue to pursue the technology, as you did, Senator Percy. I think that is an essential thing for us to do. And perhaps at some point the situation would change. But I don't think it is going to change in my lifetime, and I would hate to see us misled and proceed down a path where we don't focus on arms control and we don't focus on our diplomacy and we don't focus on continuing to improve the survivability of our existing systems to insure that deterrence works and to insure that we can maintain our safety through an international regime that we have had some experience with.

The CHAIRMAN. The last question that I have perhaps Dr. Rathjens could answer. It is good to see you again.

Mr. RATHJENS. Thank you.

The CHAIRMAN. We have always appreciated your help very much indeed.

Last year DOD placed a \$500 billion price tag on a laser-based missile defense. Can we afford this type of huge effort, especially when the Defense Department concedes that missiles could actually leak through?

Mr. RATHJENS. I wouldn't give that particular estimate much more than a ball park kind of credence. I think it may be low; I don't think that for \$500 billion we could buy a defense that would come close to protecting this country. At least 100 Soviet warheads would leak through and very likely more, if we could do it at all, so, I think it would be an enormous waste of resources. It would be equally crazy of them to do it.

The CHAIRMAN. Thank you very much. I have enjoyed listening to the panel. We very much appreciate your presence.

Senator HELMS, I wonder if you would chair until Senator Pressler returns.

Senator HELMS [presiding]. Mr. Lodol, I am disappointed to hear that you don't think that we can do this in your lifetime because you are a very young man, so that excludes my lifetime automatically.

The CHAIRMAN. Senator Pell, by the way, has not had a chance to question.

Senator HELMS. Oh, I am sorry.

Senator PELL. Go ahead.

Senator HELMS. Well, I won't be but 1 minute.

General Graham, I want to ask two or three quick questions which will be easily answered. You have already touched on each one of them but I need a little bit of elaboration.

You mentioned that your proposal, which fascinates me, High Frontier, had been criticized by both the defense bureaucracy and by the groups which I will describe as being in favor of a nuclear freeze.

Now how do you account for the criticism of High Frontier by both sides?

General GRAHAM. Senator, it is rather curious that both the military point of view that says our only chance is offense, that is the sort of big bang boys within the bureaucracy, or those that believe, as Mr. Lodal does here, that if you can't have a perfect defense, you can't have any, use the same slogan as has been used by the unilateral disarmament people and the nuclear freeze people when they say there is no defense, you cannot have a defense, or that you should not have a defense.

So that is part and parcel of the mutual assured destruction theory. A corollary of that theory is that to defend oneself is destabilizing and provocative. It is a curious wrench of logic to me that to defend oneself is provocative but to maintain a capability to blow the other fellow to smithereens is not.

But the whole thing rather reminds you of situations that we used to have in the country where a county would be dry. It would have prohibition. And the Women's Christian Temperance Union supported it and the bootleggers supported the same dry laws, although they really didn't like to talk to one another. The reason: The WCTU, like many of the legalists who believe that the only way out is through getting the right piece of paper signed, they wanted to get rid of booze by fiat, and the bootlegger didn't want to see those laws go because that allowed him to sell illicit booze.

So we have a similar kind of strange alliance these days where some alleged military thinkers or defense intellectuals say there is not or should not be a defense, and you are getting the same response from people who are supposed to be their natural enemies.

What that demonstrates, Senator, is that there is a mindset in this country that is held by many that is a mindset against strategic defense. And it came up in the mid-1960's. It was the child of Mr. McNamara. There is no need to throw stones back to the past with the clear vision of hindsight, but the fact of the matter is that technology is now available to defend not just the United States but our allies from long-range ballistic missile attack and we can do it cheaply.

So technology at least should change the minds of those who believed in the past that you couldn't get an effective defense or that it would be provocative and destabilizing.

Mr. LODAL. Senator, could I add a plug for General Graham's approach, just briefly?

Senator HELMS. Sure.

Mr. LODAL. I think one of the important things that he has done is to get us to focus on technology that is realistic. I am not an expert on his particular system, but I think that getting people to move to look toward this kind of technology, not only for space systems but quite frankly for a lot of our military programs, is crucial if we are to maintain the effectiveness we need within reasonable budgetary amounts.

I have my doubts about it, and not exactly for the reasons he said, but I do think that this is a very important contribution and should be noted.

Senator HELMS. Just as a matter of personal interest, some time last year—I believe it was last fall but I am not sure about that—Secretary Weinberger was before this committee and I asked him about High Frontier. I asked if he had talked with you about it. There was some hesitation. He looked to some of his aides and then he answered yes.

Have there been any extensive conversations between you and Secretary Weinberger, or was he meaning that the Defense Department had talked with you about it?

General GRAHAM. No. It wasn't just the Defense Department, although High Frontier has been in rather close contact with a number of people in the Defense Department and three times I have talked to Secretary Weinberger himself about High Frontier.

Secretary Weinberger, I believe, saw the strategic value of High Frontier early on, but you must realize that when we talk about this capability being available to us in the near term, we tend to get in the way and to jeopardize other ongoing programs.

For instance, the first thing we ran up against was the racetrack MX deployment thing, which of course you don't need to do if you go High Frontier. And High Frontier is scarcely support for Dense Pack either.

So High Frontier had some natural enemies within the bureaucracy of the DOD and their views were pretty consistently given to the Secretary, although the Secretary himself has said that the real answer to the strategic vulnerability of the United States lies in a space-borne capability to knock down a Soviet ballistic missile attack, once launched, before it ever reaches our atmosphere. I think he said those things without the full support of the technocrats of the Pentagon.

Senator HELMS. I am a little bit confused by the various things I am hearing, and I know you must be too, and if Claiborne will forgive me, it reminds me of what Mr. Dooley said about the distinguished Senator's party. He said "the Democrats have done fell out amongst themselves."

Am I mistaken? Didn't the President say that the Joint Chiefs of Staff had told him that the technology for strategic defense is within the realm of feasibility?

General GRAHAM. That is right, Senator. I have applauded the Joint Chiefs for giving sound military advice to their President. I don't believe the President would have ever said what he said unless the Joint Chiefs had come to him, as he said, and pointed out that the technological problems of getting an effective—not a perfect, but an effective—defense, was available. Had they not said so, I don't think the President would have said what he did.

But I think that certainly the media should be reminded that the President said not one word about lasers or particle beam weapons. He said technology, which includes the technology of High Frontier.

Senator HELMS. Well, I agree with Senator Pell. I am disappointed that the administration is not here to discuss this, particularly in light of the varying estimates of cost. Of course I don't think anybody knows—certainly I don't.

Senator PRESSLER. We hope to have the administration witnesses in May.

Senator HELMS. Yes. Now you have stated in your statement your opposition to the MAD nuclear strategy, and I don't think you could have done it more effectively than by reading the little girl's letter. That tells it all.

Now just for the record, so that it will be clear, go through that briefly. Why do you oppose MAD? That is a leading question, I know, but I think it ought to be emphasized.

General GRAHAM. MAD is a policy that says that U.S. security against nuclear devastation is totally dependent upon our ability to wreak devastation on the other side. In other words, that the vengeance will be so terrible from both sides that neither side would ever undertake nuclear war.

There were two corollaries. One is that, therefore, the peoples on both sides should not be defended because if you defend them, you reduce the terribleness of the vengeance and, therefore, it won't work. That is the reason why you see practically no strategic defense of the United States today, neither civil defense nor active defense. We did away with it. The Soviets did not, of course.

A striking figure is that the Soviets have spent 1 ruble on strategic defense against our systems for every ruble they have spent on strategic offense. We have spent \$1 on strategic defense for every \$10,000 we have spent on strategic offense since the ABM Treaty was signed. So one of us is crazy. In my view, it isn't the Soviets.

The second corollary, Senator, is that we must have arms control. Otherwise, as both sides are to be totally dependent on that fraction of their offensive force that would be left after a first strike by the other, that as the technical capabilities of the offensive systems go up, you have got to be increasing the whole pie so that the fraction left over is sufficient to strike enough targets to deter the other side.

This means that you have an inexorable force to raise on both sides to create more and more offensive systems. The only way you can break that is to reintroduce some balance between offense and defense, which is what High Frontier calls for. High Frontier does not call for a perfect defense. High Frontier calls for a balance between offense and defense.

And that is the way you get away from this awesome doctrine of mutual assured destruction and more toward the strategy of assured survival, which apparently Mr. Deudney supports. I certainly support that as well. Go for assured survival, which will give you a much stronger deterrent than we have today.

By pursuing MAD, we have created something that resembles the classic scenario of a western movie where two men are facing each other on a dusty street, each looking for the other to go for his gun, each knowing perfectly well that the first one that gets his gun out of the holster and fires has the better chance of survival.

That is the strategic situation we have today, created deliberately by the U.S. Government when we mandated the vulnerability of the United States in the midsixties. If instead we have a defense, we can get out of that most unstable of situations and create a stable situation where the contest is not between offensive nuclear weapons threatening to blow off chunks of the planet, but between nonnuclear systems in space which defend against that. And if one wants to call that an arms race in space, then fine, I say it is a far better arms race than we have here on Earth.

Furthermore, as a nationalistic type of man, I like it up there because my side wins. It has all the technical advantages.

Senator HELMS. Thank you, Mr. Chairman.

Senator PRESSLER. Senator Pell.

Senator PELL. Thank you, Mr. Chairman.

What is the definition of outer space? Where does that start?

General GRAHAM. It is not defined.

Senator PELL. Is it 100,000 feet or 400,000 feet?

Mr. DEUDNEY. There is no real natural boundary. The atmosphere just fades off into space. The Outer Space Treaty does not define that. As I indicate in my testimony, I think it has been academic until now but could become a big problem and we should attempt to address that as part of a comprehensive response to these problems.

Senator PELL. Right. This is the point I wanted to bring out. As you suggest in your statement, the first thing we should do is arrive at what the territory, if you want to put it that way, of outer space is.

Dr. Rathjens, did we cut you off a little bit? I think you had not finished what you wanted to say. Was there anything else you wanted to say?

Mr. RATHJENS. I think I had said essentially what I have to say. My summary point would be, and I would have emphasized it more, is I just couldn't disagree more with General Graham. I think almost everything he said is wrong except that he does say that perfect defense is not in the cards. That is what the President says. General Graham is more right than the President. The President said we are going to have a defense that is so good that it will make nuclear weapons impotent and obsolete. At least, General Graham doesn't go that far. But with that minor caveat, I would disagree with virtually everything he says.

Senator PELL. But I don't think the President suggested that this sky wars technique would have any protection against cruise missiles or nuclear weapons of that sort, did he?

Mr. RATHJENS. I don't believe he did. On the other hand, the Secretary of Defense appears to have said that. When pressed on the matter in press conferences, he, if I understand him correctly, and I may have misunderstood, suggested that we ought to strive for essentially an airtight umbrella kind of defense.

It is a very relevant question you raise, of course, because space-based kinds of systems that we have heard about are virtually irrelevant to dealing with the cruise missile problem, and as long as there are significant numbers of cruise missiles or the possibility, it wouldn't do us very much good to be able to deal only with the ballistic missile defense problem, even if we could.

Senator PELL. I think General Graham should have equal time.

General GRAHAM. Yes. Senator Pell, suppose we put up a defense and we made the long-range ballistic missile less useful and the Soviets said well, therefore we go to cruise. Everyone in the United States should stand up and applaud because the cruise missile is no good for a first strike of the United States or anybody else. It comes slowly, 8 hours minimum, probably a day or so before a cruise missile would get here.

So you can use it to retaliate, but I see no reason to take away a retaliatory capability from the Soviet Union, and that is why you can afford an imperfect defense but a defense good enough so that

no marshal or general sitting in the Kremlin can figure out a way to first strike the United States.

Cruise missiles are retaliatory weapons. Bombers are retaliatory weapons. If we can drive the Soviets into a situation where the nuclear strike forces are retaliatory, then we need only worry about them if we strike the Soviets first, and I frankly cannot imagine a scenario, and I believe the Soviets would have at least some of the same problems, a scenario in which the United States suddenly rears back and strikes the Soviet Union with everything it has.

So that puts us in an entirely different strategic situation. It gets us away from this terribly unstable situation we have today that I described before and puts us in a situation where, yes, both sides can retaliate, but neither side is able to first strike.

Senator PELL. Your point is well taken as far as what the United States might do. Still, our NATO strategy is based on reserving the right to first use.

General GRAHAM. Well, first use after they have been invaded by a large conventional force—yes. Now you are into the tactical nuclear business.

Senator PELL. Mr. Deudney, there is one point in your testimony that you didn't read that I was very interested in. You said, "One Department of Defense analyst put it this way: 'We would have to delegate the decisionmaking to the weapon system itself. We have had no experience in that type of operational system.'"

In other words, it would be the systems itself—the robots or whatever it would be, the machines—that would make the decision to retaliate. That, it would seem to me, would be very dangerous.

Do you have any thoughts as to how this can be better avoided?

Mr. DEUDNEY. I think we do want to get away from MAD, but I think what General Graham is proposing is really an example of what I call a DEAD strategy, which is to say it is a destruction entrusted automatic device. And as the quote from the Defense Department official indicated, systems put into space would not be under the command and control of people on the ground. There would be a 5-minute period between when the Soviet rocket was launched, detected, engaged, and destroyed. And as they say in the Pentagon, people would be "out of the decision loop." That means that the line separating us from accidental nuclear war is much finer.

In the era of MAD, it would probably require a major political misjudgment to have a nuclear war, but once these self-activating systems have been put into orbit, then it would simply require a computer malfunction.

General GRAHAM. May I respond?

Senator PELL. General Graham.

General GRAHAM. The system we talk about has a man in the loop controlling the entire system. It would fire at nothing unless it got a command from a man in the loop.

However, the system is designed to go automatic if there is a massive attack from Soviet missiles. But there is no chance of starting a war by firing at one missile coming up. You build into the system a threshold over which, when you know perfectly well that a large missile attack has taken place, that system does go autonomous. But in any normal time, that system has a man in the loop controlling it.

Senator PELL. But in an abnormal time, when, let's say, there is some explosion in outer space, some great meteor came along, could that not have the same impact with regard to your system?

General GRAHAM. No, it couldn't. In abnormal situations—let's take the Cuban missile crisis as an example—in a case like that, you would have to get on the hotline to Moscow and say, don't send things into space because this is a very nervous time and we are going to shoot down anything that comes. So don't let us kill one of your cosmonauts. Or if anybody is capable of sending vehicles into space, they have to know that we have gone on full alert.

But except in that kind of situation, the system will not operate automatically against any few things coming into space.

Senator PELL. But having given that warning, if a flock of geese, something of that sort, or an electrical malfunction occurs, then it would seem to me we would be in a very dangerous situation.

General GRAHAM. The worst possible thing that could happen—and you always have to worry about a mechanical device somehow malfunctioning—is one day you might shoot down something that would annoy the hell out of the Soviets. But what a better situation than today's world were if somebody fires a nuclear missile, there is nothing that can happen until it hits where it is going.

For those who believe in the madman theory, you know, where generals go crazy—it is always American generals, you notice, never Russian generals—and fire off some missiles, this thing can take down our own missiles as well as the Soviet missiles.

Senator PELL. I don't think anybody worries about the generals going crazy. They worry about the political leaders or they worry about the sergeants or lieutenants in the field with control of tactical weapons. I think generals, in general, are reasonably cautious.

General GRAHAM. Well, thanks for that vote of confidence.

Senator PELL. Is there any consensus here as to who is ahead in the ASAT weaponry, the United States or the Soviet Union?

General GRAHAM. The Soviets are by far ahead. They are the only ones who have an ASAT system deployed. They had it deployed when I was Director of Defense Intelligence.

Senator PELL. Do the rest of the panel agree with General Graham?

Mr. RATHJENS. Well, in a narrow sense. I think they have a system that is almost totally ineffective, and we will shortly have one that will be much more effective and very much more flexible in its use.

Senator PELL. In other words, you are saying that they have a system ahead of us now but it is not much good, but we hope to be ahead of them later?

Mr. RATHJENS. I think we will be very much ahead of them very shortly.

Mr. DEUDNEY. I agree with that assessment as well.

Senator PELL. Now, do you agree that once tested and deployed, the the F-15 ASAT will really leapfrog the Soviet missile-launched so-called killer satellite?

Mr. RATHJENS. I have no doubt of that. I think it will. It is still not going to be a totally effective system. There would be very many important kinds of satellites that will be beyond its reach. It is still relatively primitive, but it would be much more effective than theirs.

Senator PELL. Would General Graham agree with that?

General GRAHAM. I am not sure. I certainly hope that that is the case, but I am not sure that is the case.

Senator PELL. My time has expired.

Senator PRESSLER. I would ask this question of the panel and we could go right across and get answers.

The Soviets are said to be 5 or more years ahead of the United States in the development of directed energy weapons, such as lasers and particle beams. Do you agree with this assessment and do you believe that the Soviets are developing space-based BMD systems?

Mr. DEUDNEY. I would disagree with the 5-year distinction. I think that there is a tendency for the United States to impute to the Soviets a greater state of technology than they have because they tend to deploy systems and test them earlier in the development cycle than we do.

I don't think there is any doubt that the Soviets are working on lasers and a longer term application of those would be for space use. But I don't think that there is really any asymmetry right now in that capability that means anything.

Mr. RATHJENS. I can't add very much. I don't know enough in detail about what they are doing. I would be surprised if they were 5 years ahead and even more astonished if they were getting anywhere in the development of a militarily effective capability.

Mr. LODAL. I have nothing to add to what Dr. Rathjens has said.

General GRAHAM. I believe the Soviets are ahead of us in a theoretical sense in directed energy beams, mainly because they have applied such a strong effort. As far as space-based capabilities, I think that even if they are ahead, if the United States bent its will to do so, the United States could overtake them, not because we are better at developing that kind of laser or particle beam weaponry, but because the United States has a fundamental advantage in space transportation, which is the shuttle, and in miniturization.

If the Soviets ever come up with a space-based laser weapon that is truly destructive, other than one that just tries to blind optics and so forth at rather low power, I think they are going to have to put an enormous big machine up there.

Now they may be able to do that with their big booster coming along, but I still have my doubts that they are well along the road to a space-based ballistic missile defense. I am quite sure that if the United States goes with a nonlaser defense, like High Frontier, we will get it up there well ahead of anything the Soviets would do.

Senator PRESSLER. I would address this to the entire panel, and I am sorry that the administration has not chosen to appear here today. They have indicated that they would appear in May when they have done some additional studies, but the administration has briefed the press for an hour and a half on these subjects. I am disappointed that they are not here today.

This I would address again to the panel as a whole. High Frontier claims that the United States could deploy a conventional armed ballistic missile defense system for \$40 billion and that this could be done by the end of this decade. In assessing these claims, Dr. DeLauer told this committee last September that proponents have grossly underestimated the cost and the time required to complete project. One estimate from DARPA quoted in Armed Forces Journal has placed the price tag at from \$200 to \$300 billion.

These are the specific questions. First of all, in your view which assessment is the more accurate? Second, do you believe that technology already exists for deploying a system such as the High Frontier? Third, if no, what breakthroughs do you believe will be necessary before we can deploy such a defense network? Finally, do you believe that the United States can afford to build this type of capability in the absence of vastly increased taxation and without major reduction in other military areas.

Mr. DEUDNEY. I really don't have the technical expertise to assess much of this, but I think there is one important lesson to apply, and that is that whenever there is a scale-up of a system to form a small to a large one, or from one to many, cost projections are essentially guesses. A series of tests, more tests, reevaluations and so forth are going to be necessary, and it is only after we have done a lot of testing that we will have any clear sense of what it is going to cost.

Mr. RATHJENS. I think it is a rather complex question, Senator. One must ask, "defense of what?" If we are talking about defense of American cities, population and industry, I really think at the present time the situation is fundamentally hopeless. I don't believe that High Frontier or the President's kinds of proposals or anything in sight can help very much in providing security for American cities and population.

Forty billion dollars wouldn't scratch the surface. I don't think \$200 billion would even begin to make a dent on that kind of problem if we credit the other fellow with any effort at all to overcome what we might do. I don't even think we could defend against his present capabilities, even if he stood still; if he makes a concerted effort to counter what we might do, I am convinced that that problem is hopeless for a very long period of time.

Now, if we are talking about defense of a limited number of Minuteman or MX missile silos, I think that is a very different problem. First of all, we could tolerate the loss of many. They are very difficult targets to destroy as compared with cities. There is some possibility that some kind of a defense of such targets could make sense in a narrow, technical sense.

I do not believe a space-base component would, however, be very helpful. To the extent that defense of hard targets might have attraction at all, the important component would be close-in defense: attempting to destroy the other fellow's warheads when they are almost on the target. But even then, I would have my doubts about whether or not that would be very attractive.

Mr. LODAL. Senator, I think there is an element of truth in both sides of this argument. I think there is a much better chance that General Graham's approach could be deployed for a reasonable cost, whether it is \$40 billion or \$100 billion but something less than the trillion dollar numbers that one can easily construct for laser-based systems, and I think it is somewhat harder for the Soviets to come up with simple countermeasures.

But I believe there would be countermeasures, and as Dr. Rathjens said, that is what makes it so hard to estimate the cost of these things because then you have to go back and redesign and redevelop.

So I think we could afford it and I like his idea of focussing on existing technology, trying to do things in simple ways rather than

overly complex ways. Particle beams, for example, I think are completely out of the question and make no sense for us to focus our efforts on. Lasers make a little more sense but not a whole lot more, and his approach of using physical destruction mechanism I think is more sensible.

On the other hand, I think his basic strategic analysis is completely wrong and I think it is internally contradictory. He talks about the terribly unstable situation we are in today. In fact, we are in a very stable situation. The Soviets don't have anything like a first strike capability because they can't touch our alert bombers; they can't touch our submarines at sea. They in fact can't even do that much against our land-based missiles under some scenarios. And those aren't the way wars start. They start by conventional attack and escalate from there, and those aren't the main problems we have.

His system would make the Soviets, if we both had these systems, it would bring us closer to a first strike capability, not further away from it.

So I think we could afford it. I think the technology is worth pursuing. I think it is a bad idea from a strategic standpoint, not necessarily a technical standpoint.

General GRAHAM. Let me correct you if I might, Senator. We say it is even cheaper. We say we can get it for \$15 billion in 5 or 6 years.

Senator PRESSLER. \$15 billion?

General GRAHAM. \$15 billion not \$40 billion. The \$40 billion or \$50 billion figures are the reason why Dr. DeLauer could say we had grossly underestimated, so we go from \$15 billion to \$50 billion, which is what the Department of Defense argues with me about.

Now let me tell you how we came up with \$15 billion. I think it is interesting. We used technology off the shelf. We used things that people already know how to manufacture. We went to the manufacturer and said if we needed 500 of those or 10,000 of those or whatever, how much would it cost. And they told us the cost and we added up all those costs.

We went to the research and development people and said how much would it cost to put this thing together and test it, and we added that for testing. And we went to space transportation people and said how much would it cost to put these up, either on boosters or by the shuttle, and added that figure in and it comes to \$15 billion.

Now one of the reasons we got rather low unit prices is that in space hardware, we have never made but a few things at a time—you know, two or three of these satellites. I think the biggest number we have ever produced so far of a single type was 10. Recently a contract was let for 28 satellites of the same kind. This was an astonishingly big order.

We are talking about 500 satellites of the same type. We are talking about not building a handful of prototypes but building a lot. And that caused the estimates from industry to drop way down in terms of unit cost because you have practically no R&D tail hanging on to the back end of every item you buy because the R&D has already been paid for if you go with off the shelf technology.

So we stick to our \$15 billion. We are not adequate about it. When the Department of Defense says \$50 billion, they say but not in 5 or 6 years the way you say in High Frontier, but in 10 or 12.

Our answer to that is you are right. If you take 10 or 12 years to do this and use the terribly complex redtape snarled acquisition systems of the Department of Defense, it will indeed cost \$50 billion because the actual development and production times and deployment times are only 5 or 6 years. So you are stretching it out 5 or 6 years. When you do that, then the judgment of the General Accounting Office, which said that for every year you stretch an acquisition out beyond the actual development and production time, it adds 25 to 30 percent to the end cost of the items.

Just apply that to the additional 5 or 6 years and you will find that yes indeed, Department of Defense, you are correct if you don't manage this thing without a short-cut system.

Now the Air Force Journal did in fact quote \$300 billion, but as we have told your staff, they were quoting Aerospace Co., which said it would cost \$300 billion to do something like High Frontier, but they didn't even have our study in hand, and they came up with a system that involved not 432 satellites, such as we say are necessary, but 9,000 satellites. That is why you got a \$300 billion figure, and nobody holds to that \$300 billion figure any more in Government.

Senator PRESSLER. Are you familiar with Dr. Robert Cooper's testimony before the Senate Armed Services Committee in March of 1982?

General GRAHAM. Yes; I was there.

Senator PRESSLER. He estimated that the High Frontier would cost between \$200 billion and \$300 billion to deploy. He seemed to be referring to your exact system here. He says "as proposed by High Frontier".

You probably have responded already to what he said, but I want you to have a chance to respond to that. I would like to put Dr. Cooper's statement in the record at this point and your statement right behind it so we can try to shed some light on this controversial area.

[Excerpted statement of Dr. Robert Cooper, Director, DARPA, before the Senate Armed Services Committee, March 1982:]

Dr. COOPER. The primary objectives of the space-based Global Ballistic Missile Defense (GBMD) system, proposed by High Frontier, is to perform what is called the Damage-Denial Mission. The ability to field a weapon system capable of destroying Soviet boosters and denying them the ability to inflict any damage on the United States would represent an ultimate achievement. The DOD has worked with the High Frontier analysts throughout the development of their concept and supports the basic Damage-Denial goal. However, as hardware developers of war fighting systems, we do not share their optimism in being able to develop and field such a capability within their timeframe and cost projections. We have conducted several inhouse analyses and have experienced some difficulties in ratifying the existence of "off-the-shelf components or technologies" to provide the required surveillance, command and control, and actually perform the intercepts within the orbital and physical conditions described. Our understanding of systems implications and costs would lead us to project expenditures on the order of \$200 to \$300 billion in acquisition costs alone for the proposed system. While we are somewhat skeptical of the particular GBMD concept design, we will be interested in seeing how new technologies or other concepts may be employed to achieve a Damage-Denial Mission in a cost-effective manner.

General GRAHAM. Right. That was in March 1982, Senator Pressler, and at that time High Frontier's idea had hit the Pentagon like a great bomb. They had done very little real work on it. As a matter of fact, I believe it was at that same hearing that Senator Warner was asking Dr. Cooper about it and he says High Frontier

would be all right but we cannot develop lasers that fast. In other words, he had not read our study and believed we were talking about lasers.

Senator PRESSLER. He said:

The primary objective of the space-based global ballistic missile defense system proposed by High Frontier is to perform what is called the damage denial mission.

Then he says:

The DOD has worked with the High Frontier analysts throughout the development of their concept and supports the basic damage denial goal.

He goes on:

Our understanding of the system's implication and cost would lead us to project expenditures on the order of \$200 to \$300 billion in acquisition costs alone for the proposed systems.

But as you say, that may have changed.

General GRAHAM. That is old. I will tell you that the cost argument between High Frontier and the Pentagon now, as near as I can divine, and I have talked to many people about it, lies in whether or not the individual hit vehicles that are on our satellites can be had at the price that we had quoted to us by Ling Temco Vought Co. of Texas. We are looking at that again and I am sure the Department of Defense is looking at that again.

If we are right, then our figure is right. If they are right, it will cost more. But I think if you ask Dr. Cooper today, those old figures of \$200, \$300 billion that he was quoting in fact came from the Aerospace study in which they were instructed to shoot down High Frontier.

Senator PRESSLER. Senator Pell.

Senator PELL. Thank you, Mr. Chairman.

I wonder if there is any consensus here as to which country is more dependent upon outer space—do we say space or outer space? What is the technical term?

General GRAHAM. Either way.

Senator PELL. Which country is more dependent on space or outer space for its peacetime operations, the United States or the Soviet Union?

General GRAHAM. For peacetime operation?

Senator PELL. I would think it would be us, would it not?

General GRAHAM. Well, I think it is us and it should be even more so.

Senator PELL. Do you all agree on that?

[Messrs. Lodal, Rathjens, and Deudney all nod in the affirmative.]

Senator PELL. Isn't one of the difficulties, as I understand it as a layman, that you can have the same vehicle, say the shuttle, which can be used for military purposes carrying a load of nuclear satellites or for civilian purposes, and the problem really in any kind of treaty is the inspection, the verification of that treaty?

How do you think this can be handled, because you can't stop—nobody would want a treaty that would stop movement into space because that is inevitable and that is progress, I guess. How does one make sure of the verification portion of such a treaty? Would it have to require onsite verification?

General GRAHAM. I think it would. For instance, if, as I truly suspect will happen, that more and more militarily capable satellites are

going into space, that you probably will need to make an agreement, if you can get one with the Soviets, that when these things are launched, that somebody is close enough to it with a Geiger counter that they know that they don't have any nuclear weapons aboard.

Let me say one more thing, though. The United States is also more dependent upon the high seas than the Soviets are commercially for our civil use, and to attempt to demilitarize the high seas wouldn't make any sense to me.

Mr. LODAL. Senator, I think it is important how you look at the problem. In its absolute sense, I think it is even worse than you and General Graham have indicated. I don't believe onsite inspection would solve it for you. If you look at antisatellite weapons, they are not satellites in and of themselves. So even if you got an agreement to inspect every satellite that went into space, that doesn't solve the antisatellite problem.

Now on the other hand, if you—and there is a long way to go with the Soviets, but I do believe it is possible to rule out certain large-scale kinds of activities that we, 15 or 20 years from now, could easily look back and say we would have been better off had we mutually ruled these out, large-scale antisatellite activities and large-scale war-in-space kinds of activities.

And I believe it is important to retain the treaties we have today, such as the ABM Treaty, which would be violated by any of these systems that we have talked about, whether it is High Frontier or laser ABM systems. Those would violate the treaty. Their development as well as their deployment, but even just their development would violate it. I think it is important to retain the progress we have made and look at these other opportunities.

Senator PELL. Dr. Rathjens and Mr. Deudney, would you confirm—

Mr. RATHJENS. I can't add very much to that. The question of verifiability depends upon what you are trying to prohibit or proscribe. You could get some handle on the problem by limitations on testing and by observations relating thereto. That would have been the way to handle the MIRV problem, for example. Rather than to try to look for MIRV's on the end of missiles, we would have done better, I think, to have had agreements that prevented their being effectively tested.

Now, there is a possibility with respect to some kinds of satellites of going up there and taking a look. We could get as close as we wanted.

Senator PELL. An international air guard.

Mr. RATHJENS. I suppose so, yes. But in other cases, we would want to look at the payload on the ground. I should add that I do think we have made some small progress in getting acceptance of that idea by the Soviet Union, though we have a long way to go.

Senator PELL. Mr. Deudney.

Mr. DEUDNEY. I am somewhat more optimistic about the verifiability of even an antisatellite treaty. I think that there are certain types of activities which would have to be banned, whole classes of activities which would be observable. They would be, in the language of a SALT process, functionally related observable differences. We would have to ban things like collisions or close flybys. We would have to ban explosions after a rendezvous. We would have to place constraints on the size of lasers.

And if we were to do that, not only could we observe that was occurring because we have fairly adequate tracking capability, but we would make impossible the use of civilian technology for the military purposes.

So I think that there is a high degree of verifiability that we could build into such a system if we do it now, because the tests haven't extensively occurred.

Senator PELL. Do you think there is any practicality to the thought that Dr. Rathjens had that we might have an international space guard, like the Coast Guard?

Mr. DEUDNEY. I think that having verifiability reinforced on the international level is good, but I don't hold much hope, at least in the short term, in the type of satellites that would go up next to another satellite and look at it. First of all, that would be an orbital rendezvous technique that is identical to the Soviet weapon. Second, rendezvous themselves or close proximities result in outgassings or various forms of debris that would damage satellites and would constitute an important form of interference, particularly with reconnaissance satellites.

Senator PELL. Going back, Mr. Lodal, to the question of the ABM Treaty, I thought the ABM Treaty only talked about weapons of mass destruction, and lasers and particle beams are not weapons of mass destruction, are they?

Mr. LODAL. No, sir. It talks about any ABM system based in space, article 5 I believe it is, and not only in space but in the oceans and so forth.

Senator PELL. You are correct and I am wrong. I am confusing this with the Outer Space Treaty.

Mr. LODAL. That is right. There are basically not only the Outer Space Treaty and the Limited Test Ban but the ABM Treaty all deal with weapons in space. There are three treaties, and the ABM Treaty is frequently overlooked.

Senator PELL. Then I would like to ask General Graham, if we did go with his High Frontier strategy, wouldn't that necessitate the abrogation of the ABM Treaty?

General GRAHAM. No.

Senator PELL. Why not?

General GRAHAM. It would not because when you look at article 2 of the ABM Treaty it says "For the purposes of this treaty, this is an ABM system."

Mr. LODAL. That is not correct, Senator. I think if you have the treaty there, you might read it.

Senator PELL. It says, "For the purposes of this treaty, an ABM system is a system to counter strategic ballistic missiles or the elements of flight trajectory currently consisting of," and so forth.

General GRAHAM. Yes, read the "currently consisting of".

Senator PELL. ABM interceptor missiles, which are interceptor missiles constructed and deployed for an ABM role of the type tested in an ABM mode; ABM launchers; ABM radars and so forth.

General GRAHAM. Well, it is the latter part of that which would cause you to refer to another place in the treaty to handle something like a space-borne defense. That is under the part of the treaty that deals with ballistic missile defenses based on other physical principles. It says what do you do if you come up with such a system?

Well, what you are required to do by the treaty is to sit down and discuss that with the other side to see how it will be handled in the treaty. What we should do is sit down and discuss that with the Soviets to see how it is included as something you can do within the treaty.

So my view: yes, you can deploy this, but you are obliged to sit down and talk about it with the Soviets.

Senator PELL. Mr. Lodal, do you concur in that?

Mr. LODAL. Senator, this is a very common and very wrong reading of the ABM Treaty, not only its negotiating history but what it says. In fact, it says that "an ABM system is any system that is designed to counter ballistic missiles in their flight trajectory, currently consisting of—". And it was written that way on purpose, saying that the general prohibition is what applies in the treaty. The "currently consisting of" is strictly a description of today's situation.

What the paragraph says about systems based on new technology, if you read that, it is talking strictly about land-based systems. It doesn't at all interfere with the previous prohibition on space-based systems, which is absolute and comprehensive. It talks about land-based systems that might be based on new technologies, and therefore might not be countable in the same sense as interceptor systems, and says in that case they have to be subject to discussion.

But that is a further limitation. It is not a broadening of the treaty. And the prohibition on space is absolute.

General GRAHAM. May I add something? Let me cut through that knot. If you want to look at the treaty as a guardhouse lawyer to protect the Soviets against our deploying a space-borne system, you can make the case. If you want to look at the treaty as a guardhouse lawyer figuring out a way to deploy it and not violate the treaty, you can do that, too.

Now if you want to be most honest about it, you just simply go straightforward with an amendment to the treaty that says Soviets, if you want to put up a system that guards against a U.S. first strike by long range missiles, you go ahead because we want to do that; we want that in the treaty.

Senator PELL. Thank you. Thank you very much.

Senator PRESSLER. Following up on that, we should have the administration here. We requested them to be here today but they declined until they have studied the matter further. They have assured us they will come in early May.

Dr. Cooper did make a statement on this very subject, and I am going to place his reply to the question—it is the best thing we have at this time. We will ask him again in May on the ABM Treaty. He responded to a question from Senator Warner in the Armed Services Subcommittee on Strategic and Theater Nuclear Forces.

[Dr. Cooper's response to Senator Warner on the ABM Treaty follows:]

Senator WARNER. Dr. Cooper, would a space-based laser ABM system be contrary to and require modification and/or abrogation of the ABM treaty?

Dr. COOPER. The ABM treaty bans the development, testing, and deployment of all ABM systems that are space-based; however laboratory research is permitted. Modification of or withdrawal from the treaty would be required before development, testing, or deployment of a space-based laser ABM system. Ballistic missile defense is, however, the most demanding mission for a space-based laser weapon system, and less capable systems could be developed for other missions, such as

attacking satellites or high flying aircraft. Development, testing or deployment of an anti-satellite or air defense space-based laser weapon system is not prohibited by the ABM treaty unless it has a distinct capability as an ABM system.

Senator WARNER. At what point would its development require such a change?

Dr. COOPER. The term "development," as defined in the ABM treaty context, was explained by the (then) Director of the Arms Control and Disarmament Agency, Gerard Smith, on July 18, 1972, in testimony to the Senate Armed Services Committee:

"The prohibitions on development contained in the ABM Treaty would start at that part of the development process where field testing is initiated on either a prototype or breadboard model. It was understood by both sides that the prohibition on "development" applies to activities involved after a component moves from the laboratory development and testing stage to the field testing stage, wherever performed. The fact that early stages of the development process, such as laboratory testing, would pose problems for verification by national technical means is an important consideration in reaching this definition."

Senator PRESSLER. Let me ask a question. A space-based laser defense network will involve far more advanced technology than would be required for a system designed along High Frontier lines. What do you believe it will cost and how long will it take before a laser defense system in space could be possible?

Mr. DEUDNEY. I do not think that a laser system in space that will be effective against countermeasures will ever be possible, and it is the countermeasures that are important. These systems are going to be large; they are going to be vulnerable. It is possible to make maneuverable warheads, and the like.

So I do not think we are ever going to see it as a militarily viable technology unless the other side simply stands still, and the record thus far shows that we will probably have action-reaction continuing into space.

Mr. RATHJENS. I think that is basically correct. I do believe we could probably build space-based systems using lasers that could be effective in blinding or destroying limited numbers of satellites. I do not believe that we could build a system at any time, as far as I can see into the future, that would be able to cope with a significant number of ballistic missiles if the other fellow were making a concerted effort to defeat it.

There is a big difference between destroying satellites on the one hand, a few satellites, and a large number of ballistic missiles on the other.

Mr. LODAL. Senator, to give an illustration of the magnitude of the problem, you need to improve laser systems by about a factor of 1,000 to make them work; even if the other side doesn't take any countermeasures, because you need to get about 10 times more power out of a laser; you need to get about a 10 times bigger mirror to reflect it; and you need to get about 10 times more accuracy in aiming it before you can hit anything. If the other guy then takes countermeasures, you have a lot longer to go.

That is why technology such as High Frontier I think make more sense, such as the kinds of ballistic missile defenses for our ICBMs that Dick Garwin suggested, and I think we should put more of our research and development into those kinds of technologies and less of it into the esoteric but perhaps more exciting technologies for the people who are doing the work.

General GRAHAM. Well Senator, you know one has to watch, asking a question of technology and cost about space-borne defensive systems

when you are asking somebody who says he wouldn't want it if he could get it free tomorrow.

Now as far as how long it would take to get an effective laser or other energy beam weapon, our estimate in the High Frontier study is that it would take 10 or 12 years. That is why we didn't go for it. For one thing, if you could have got it nearer in, we would have contemplated it.

I, for one, before I got the scientific and technical team together, thought we would come up with lasers. We did not.

What it would cost, though, is entirely dependent upon which of the many possibilities for laser weaponry you go for. There are chemical lasers, free electron lasers, and X-ray lasers, which is Ed Teller's favorite. Nobody has developed that technology to the point where you can make an estimate of how much they would cost.

So we don't make any estimate of the cost of anything in High Frontier that we could not verify by going to the people who would have to produce the hardware. There are no such people today in those technologies. So we don't know how much that would cost.

Senator PRESSLER. I want to thank our witnesses for being with us this afternoon and bearing with us during the delays. We very much appreciate your testimony.

There are some photographs I am submitting for the record; the U.S. ASAT interceptor, an artist's conception of ASAT being fired from the F-15; an artist's conception of the ASAT target satellite; and, an artist's conception of the Soviet ASAT in attack.

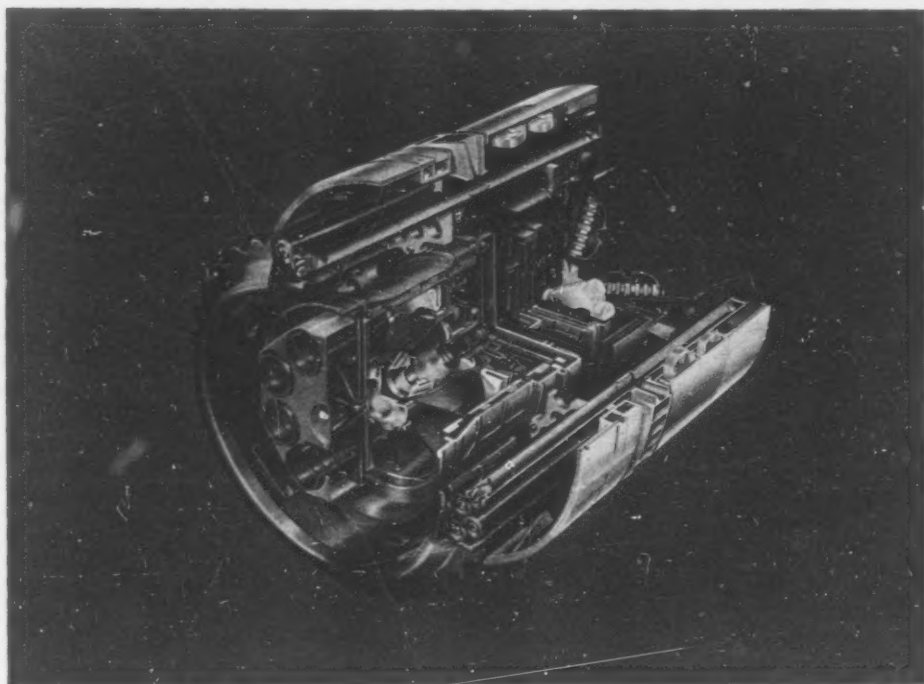
[The photographs referred to follow:]



U.S. ASAT Interceptor, Called the "Tomato Can"



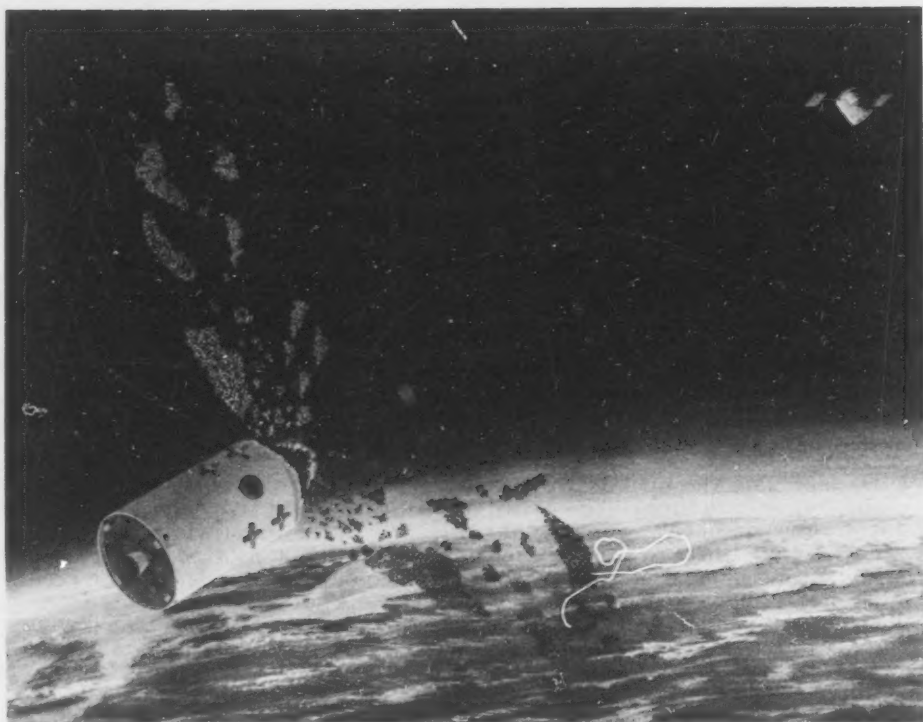
Artist's Conception of ASAT Being Fired From the F-15



Anti-Satellite Miniature Vehicle

VOUGHT CORPORATION
an LTV company

Artist's Conception of ASAT Target Satellite



Artist's Conception of the Soviet Antisatellite Weapon Making an Interception

Senator PRESSLER. Also, there are some Op.Ed. pieces that should appear in the record if there is no objection. Mr. Lodal's Washington Post Op.Ed., Fred Ikle's article in the Washington Post which appeared March 27, Harold Brown's Op.Ed. piece and William Perry's Op.Ed. piece would be excellent ones to include, plus others that Senators have to offer, will, I think, shed light on this entire matter.

[The material referred to follows:]

[From the Washington Post, Mar. 27, 1983]

NO, MR. REAGAN, IT WON'T WORK

NO TECHNOLOGICAL MAGIC WILL RENDER NUKES OBSOLETE

(By Jan M. Lodal¹)

In his speech last Wednesday night, President Reagan urged American scientists "to turn their great talents to the cause of mankind and world peace: to give us the means of rendering . . . nuclear weapons impotent and obsolete."

The world would surely rejoice if such a feat were possible. Unfortunately, it is not. Following the president's proposed course would only create false hopes and, in all likelihood, intensify nuclear dangers rather than diminish them.

There are, to begin with, serious doubts about the technical feasibility of defense against ballistic missiles that the Soviets could not easily counter—doubts that were aired widely in the late '60s and early '70s.

Our nation has overcome many technical challenges in the past, of course, and we certainly should not shrink from another if it would end or seriously reduce the threat of nuclear war. But the president's approach has problems that go far beyond technology. Consider just five:

1. Defending against bombers and cruise missiles. Ballistic missiles are only part of the nuclear threat we face. For example, low-flying bombers and terrain-

¹ Jan Lodal is a former senior staff member and director of program analysis for the National Security Council.

hugging cruise missiles could pass unaffected through a defense such as the president proposes.

In fact, as unlikely as it may seem, defending against nuclear-armed bombers and cruise missiles is an ever greater technical challenge than defending against ballistic missiles. And if the defense against the bombers and cruise missiles were not perfect, the weapons that "leak through" could destroy the ground-based components of the ABM system itself. Unless a defense can keep out all types of weapons, it is useless in a nuclear war.

2. Our allies. President Reagan said that our defense should destroy Soviet missiles before they reach "our own soil or that of our allies." But the Soviets have many ways to launch nuclear weapons against our allies in Europe that would be unaffected by an ABM defense. They could use aircraft, nuclear artillery or even armored vehicles carrying "atomic demolition munitions" with an invading force. It is inconceivable that an effective nuclear defense could be developed for Europe.

3. Treaty commitments. The president says he will carry out his program "consistent with our obligations under the ABM treaty." But, that treaty explicitly prohibits not only the deployment but even the development of any system based in space—the most likely candidate for the technological breakthrough the president seeks.

4. Destabilizing the nuclear balance. One can envision a world in which the nuclear powers have limited offensive capabilities and effective defenses. A small residual offensive nuclear force would still deter some wars, while the defense would eliminate threats from third countries and concerns about accidental attacks, and perhaps even the threat of massive destruction should war occur. But how do we get from where we are to this Nirvana?

Without a complete political reconciliation with the Soviet Union (which Reagan certainly does not anticipate), the initiation of large-scale ABM deployments by either side would be seen as an attempt by the other to enhance its capability to fight a nuclear war successfully.

The Soviets would understand this and undoubtedly respond with countermeasures to any ABM we deployed. The result would be a new escalation of the arms race, greatly exacerbated international tensions, and increased risk of nuclear war.

5. Cost. A full-scale ABM program, carried out in combination with the other necessary elements of such a posture (defense against bombers and cruise missiles, civil defense, defense of our allies, and a buildup of conventional weapons to offset the reduction in nuclear deterrence) could easily double our current \$250 billion-a-year defense budget.

The nation could afford this if it had to—defense would still be only about 12 percent of our Gross National Product. But it would call for an overwhelming national effort, requiring all elements of our society to be involved in active preparation for the possibility of war. It is inconceivable that the American public would support such an approach.

The president obviously is sincere in his concern about the risk of nuclear war and in his desire to marshal our scientific strength to reduce or eliminate this risk. But, unfortunately, some problems simply are not susceptible to easy technological solution.

There is no way we can turn the technological clock back on the overwhelming power of nuclear weapons. Our best hope is to negotiate effective arms control agreements that contain the risk and ultimately eliminate it. As we pursue negotiations, we must maintain strong and effective military programs that will deter Soviet aggression. But it is folly to pin our hopes on the chimera of a perfect or safe defense.

[From the Washington Post, Mar. 27, 1983]

REAGAN'S NEW IDEA—WHAT ABOUT IT?

President Reagan electrified the nation's nuclear debate last week by proposing to study whether an effective system might be developed in the next century to destroy Soviet missiles during their flight through space. The idea is that such a system would allow the current doctrine of deterrence, with its terrifying threat of vast mutual death and destruction, to be set aside. We invited three ranking defense experts to

evaluate the president's proposal: Fred C. Ikle from the Reagan Pentagon, and Harold Brown and William J. Perry, who served under Jimmy Carter.

THE VISION VS. THE NIGHTMARE

(By FRED C. IKLE)

Over the last two decades, two broad views of the future in the nuclear age have been contending in American strategic thought. Both views recognize that our own defense effort must be complemented by internationally agreed policies that will restrain and reduce the nuclear arsenals.

But if peace is to be preserved, according to the first view, mankind must remain locked into permanent hostile confrontation of missile forces poised for instant retaliation. The second view searches for ways to stop a nuclear attack rather than relying exclusively on the threat of revenge, and seeks to harness science and technology to reduce the role of nuclear arms. In the 1970's, the first view largely dominated our strategic policy.

The first view is like a permanent nightmare; the second view is a vision of the future that offers hope.

According to the first view, we must, for the indefinite future, rely on strategic forces that can revenge a missile attack but not defend against it, on weapons that can destroy cities but cannot protect them, on forces forever poised to avenge but never to save lives.

This view implicitly accepts a world of nations frozen into an evil symmetry: two "superpowers" forever confronting each other with hair-triggered missile arsenals, leashed precariously by the fear of "each side" that its society is threatened by devastating nuclear retaliation. This view of the world imagines that the U.S. and Soviet governments act alike. Indeed, it is the hallmark of this strategic philosophy that "they" and "we" are always interchangeable. If the United States has some legitimate fears about Soviet military policies, "they" must have exactly symmetric fears about us. If we base our defense on a need to deter Soviet military aggression, "they" must be driven by a symmetric objective. Moreover, there is no room in this simplistic view for the fact that more than "two sides" control nuclear weapons, and more nations will yet acquire them. And little allowance is made for the risk of accident and irrational acts.

If we continued to follow this nightmare view of the nuclear age, arms control would hit a dead end. Since "each side" in this view must retain offensive forces able to ensure nuclear revenge, reductions in missile arsenals at some point become destabilizing. Indeed, some people of this persuasion have criticized the arms reductions proposed by President Reagan as endangering the stability of the "mutual" deterrent relationship. If nuclear weapons must remain forever invincible, then arms control could never lead to low levels of nuclear offensive arms since, in a world without defenses, a few hidden weapons could mean a decisive military advantage.

Worse yet, according to some proponents of this nightmare view of the world, arms policy must rig our strategic forces so that they could only be used to kill civilians, not to destroy military targets. Consonant with his attitude is the belief that outer space, rather than the cities we live in, ought to be protected from military competition. Thus, the president's decision to pursue defenses against ballistic missiles is being criticized as "militarizing" outer space. What are the priorities of those who eschew possibilities for increasing the security of the space we live in, just so as to preserve some pristine sanctuary in *outer* space?

The president's decision to remove the doctrinal blinders against strategic defenses cannot overcome our current predicament overnight. But it offers a new hope. To travel the road now being unblocked will call for much careful choice and thoughtful change. Research and development priorities will have to be pursued; and as we realize the vision of a different and safer strategy, we must continue to include our allies in this development.

The scope and opportunities have now been widened for arms control negotiations that can grapple with the fundamentals. There is evidence to suggest that over time the Soviet Union will become receptive to such a new approach. Sixteen years ago, at a U.S.-Soviet summit meeting in Glassboro, N.J., President Johnson argued that arms control negotiations should give top priority to curbing systems that could defend each country against ballistic missiles. The Soviets disagreed: "I believe," Kosygin explained, "that defensive systems, which prevent attack, are not the cause of the arms race, but constitute a factor preventing the death of people."

The nightmare view of the nuclear age has broader implications, going well beyond the question of missile defenses. It becomes an excuse for not improving our conventional defenses, for a reckless reliance on nuclear escalation: "Any major war will 'go nuclear,' any use of a nuclear weapon will mean global holocaust, so why spend more money on conventional forces?" It is symptomatic of the incoherence of the nightmare strategists that they usually hold three incompatible positions: that we can safely cut our conventional defense budget, that we can safely rely on the threat of nuclear escalation, that any use of nuclear arms will mean the end of the world.

The Reagan administration has emphasized conventional force improvement, precisely to reduce our reliance on the threat of nuclear escalation. "We must take steps," President Reagan said Wednesday night, "to reduce the risk of a conventional military conflict escalating to nuclear war by improving our non-nuclear capabilities. America does possess—now—the technologies to attain very significant improvements in the effectiveness of our conventional, non-nuclear forces."

Given congressional support for the president's defense budget, we can improve and deploy conventional forces that would be effective. Such forces could discriminately repel an attack—without destroying ourselves or our allies. In this way, and in this way only, will we have an effective deterrent to conventional aggression.

As the president stressed, we face a formidable task and there will be failures and setbacks. But we can count on the common sense of the American people to reject the permanent nightmare and support the vision that offers hope.

[From the Washington Post, Mar. 27, 1983]

IT MAY BE PLAUSIBLE—AND IT MAY BE INEFFECTIVE

(By Harold Brown¹)

In June 1980, Geng Biao, the senior defense official of the People's Republic of China, visited the United States. On Geng's Sunday afternoon arrival, President Carter, who was then about to watch "The Empire Strikes Back" in the White House projection room, suggested I bring Geng over to meet him. The group, including spouses, White House staff and their families, watched laser beams, death rays and spaceship destruction on the screen. Afterward, I told Geng that this equipment was not yet ready for consideration for U.S. forces, let alone transfer to the PRC?

What a change three short years have made! President Reagan now "offers a new hope for our children in the 21st century," based on directed-energy weapons, including nuclear weapons, laser beams, particle beams and all the panoply of Darth Vader and Luke Skywalker. Like the nuclear freeze movement, the president's approach is a slogan and a drama, not a program.

But these are serious matters. For over three decades, the prospect of nuclear retaliation against the military forces and urban-industrial strength of a potential attacker has operated as a deterrent to prevent nuclear war, and even to prevent direct conventional conflict between the forces of the superpowers. Yet to rely on the threat of mass destruction to preserve peace is morally disturbing. And military leaders naturally see their functions as being able to prevent an attack, if it occurs, from destroying their country, rather than being able to avenge their country, after it is destroyed in an attack.

For decades there has been a reaction to the destructiveness of nuclear weapons and to the strategy of deterrence, along the following lines. It has again become intellectually and politically influential. This is the position that a threat produced by technology can be alleviated by a combination of determination and additional technology—that nuclear weapons are simply another form of warfare and that an effective military counter can be found to it, just as to other forms of warfare. There is a major flaw in this approach. It is that a millionfold increase (from tons to megatons) is extremely difficult to overcome, even with the best combination of technology and determination.

¹The writer, secretary of defense in the Carter administration, is Distinguished Visiting Professor at the Johns Hopkins School of Advanced International Studies and author of a forthcoming book "Thinking About National Security."

If a single weapon can destroy a city of hundreds of thousands, only a perfect defense (which, moreover, works perfectly the first time) will suffice. The extreme destructiveness of nuclear weapons is magnified by the concentration and fragility of urban society. To this must be added the availability to the attacker of the tactic of concentrating its forces to saturate and overwhelm any possible defense, even if an individual defensive weapon can destroy an individual attacking weapon.

In these circumstances, the prospects for a technical solution to the problem of preserving modern society in the face of an actual thermonuclear war—whether that solution calls for laser-antiballistic missile systems in space, elaborate civil defense schemes or combinations of these with counterforce capability (that is, ways of destroying enemy weapons before they are launched) seems to me very poor. The effort to attain such technical solutions could itself be quite dangerous if it created an illusion that such a solution has been achieved or is likely to be.

Deterrence must leave no doubt that an all-out nuclear war would destroy the nation—and the leadership—that launched it. Realistically, we must contemplate deployments by both superpowers, investing huge amounts in such defensive systems. If a clever military briefer, in a time of grave crisis, with such systems in place, can persuade the political decision-makers that the defensive systems, operating together with other strategic forces, had a reasonable chance to function well enough to result in even a severely damaged "victory," the scene will have been set for the ultimate disaster.

There are indeed new ideas for directed-energy weapons aimed from space or from the Earth's surface, which could attack ballistic missiles during their powered phase, in flight, or during reentry. Some of them have been funded by the Department of Defense for five years or more, and hundreds of millions of dollars have been spent on them. Such weapons could involve nuclear explosions, laser beams, charged or neutral particle beams, material pellets, or combinations thereof. Calculations and very preliminary experiments—some of them promising—exist, but these ideas are far (as President Reagan implies, decades) from the stage of deployed systems. Their physical principles may not work. The combination of engineering needs—energy generation, target acquisition, pointing, etc.—may be not be feasible. Or the costs of such systems may be greater than the cost of countermeasures to defeat them.

I believe that one or more of these defects will prevent all such active defenses against ballistic missiles from proving practically effective. Moreover, they will not work to defend against air-breathing systems (bombers and cruise missiles)—particularly those using "stealth" technology—that fly low in the atmosphere. Air-breathing systems, however, take hours to reach their targets and thus allow more time for decision in crisis. In that sense, they are less dangerous than ballistic missiles.

In any event, I could be wrong in my negative technical evaluations. Moreover, the United States needs to know what defenses might be deployed against our own ballistic missiles. And a world in which nuclear destruction was not possible would be a greatly preferable one to what we have now. I therefore support research and study of such defense technologies, and thinking about the systems to which they might be applied. Research and study—but not development, testing or deployment of space-based systems—are permitted by the AMB Treaty of 1972.

But these activities should be carried out in a spirit of skepticism sorely missing in the president's speech, and at a level and pace consistent with their unlikelihood of producing the advertised technical and military revolution. There is danger of alienating our allies by what may seem an attempt at creating a Fortress America. And we must remember to guard against the most dangerous outcome of all. That would be the deployment of defensive systems on both sides (and we must expect that if one superpower does so, the other will emulate it before long) that are incorrectly thought to be effective in preventing the success of a retaliatory strike.

My concern is that the ideas presented to the president are likely when developed to fall into that category of the plausible but ineffective. Some of his words expressed such cautions, but the enthusiastic tone and especially the context of a major presidential speech will magnify public expectations. To the extent that attention to far-out technological approaches to active defense against ballistic missiles detracts from programs to retain deterrence, or distracts from arms control efforts, the results could be dangerous indeed. The search for technological breakthroughs is no substitute for political and negotiating skill, nor for compe-

tent military planning and strategy. The proposed defenses against nuclear attack, which could well become the first trillion-dollar defense system, would then constitute a nightmare rather than a hope we would leave to our children in the 21st century.

[From the Washington Post, Mar. 27, 1983]

AN EXPENSIVE TECHNOLOGICAL RISK

(By William J. Perry)¹

The president did not actually describe any specific technology underlying his hope of defending the country against nuclear attack. But administration officials in background briefings after the speech suggested that a primary emphasis be placed on directed energy weapons, one possibility being space-borne lasers. Therefore, it may be illustrative to consider the prospects of this particular technology for providing an effective defense for the country.

A space-borne laser system is by no means the only approach to ballistic missile defense but, among the exotic technologies being considered, it is the most mature and best understood. The Defense Department has invested some \$1 billion in high-energy laser technology in the last decade, during which time substantial technical progress has been made. Even more technical progress may be confidently predicted in the coming decade, especially with the projected increase in funding. Still, the most optimistic forecast I can make is that this technology could produce an operational system capable of degrading a nuclear attack, but not capable of protecting the nation from devastation in the event of a massive nuclear attack. To understand this conclusion, it is instructive to consider the operational concept of such a system.

A space-based laser would be designed to attack an ICBM by burning a hole through the rocket during the period that the missile was still under powered flight. The ICBM would thus be destroyed, not only before it reached its target but before it even had a chance to release its multiple warheads. To hit the ICBM target with enough laser energy would require having the laser on a low-altitude satellite "battle station" that must be located over the launch area when it fires its laser beam. Because of the orbital motion of the satellite, not one but a whole constellation of satellites—about 20—would be necessary to shoot down any particular ICBM at any given time that it might be launched.

A few seconds would be required to detect, track, lock on, and dwell on the target long enough to burn a hole through it. Therefore, any given laser is tied up for several seconds in this operation which has to occur during the few minutes the ICBM is in powered flight. The 20 satellites required for continuous coverage of the launch area could attack in sequence perhaps a few tens of ICBMs that were launched simultaneously, but they could not handle a mass attack of even a few hundreds of ICBMs from one geographical area. Therefore, the base number of 20 satellites would have to be multiplied by about 10 to deal with a mass attack. In other words, several hundred satellites continually orbiting the Earth would be needed to maintain enough laser beams to deal with a mass attack against the United States.

The necessary laser weapons in these several hundred battle stations would be immensely complex. The lasers would require an operational pointing and tracking accuracy of a few inches at a range of a few hundred miles; that is, better than one part in a million accuracy, requiring a feasible but difficult and expensive development program. Once the beam is properly pointed, it must have sufficient energy to burn a hole in the missile skin. This would require a more than tenfold increase in power over what has already been demonstrated for high-energy lasers. Finally, the reflecting mirror of this whole system would need to be several times larger than any that has been built so far, even on the ground. I believe that these problems would eventually yield to a determined and expensive development program, but this new generation technology would have to be demonstrated before we could begin to build the hundreds of operational laser weapon systems and put them in space.

¹The writer, managing director of Hambrecht Quist, Inc., an investment banking firm, was Under Secretary of Defense for research and engineering in the Carter administration.

A laser system with these capabilities would likely be too large to be launched from the space shuttle. For each of the several hundred battle stations four or five shuttle launches may be required to place its components in orbit for assembly in space. (During this assembly phase, the system would be extremely vulnerable to attack or disruption.) My most optimistic view is that such a program would cost well in excess of \$100 billion in today's dollars and could not reach a beginning operation status until some time in the next century.

If we spend two decades developing, testing and then deploying a system to defeat the Soviet ICBM and SLBM forces, they certainly have ample time to consider, develop and deploy a variety of countermeasures. Some of these are straightforward. Against lasers, for example, infrared decoys might be used to simulate the heat signatures of missile launchers. Another countermeasure would be to rotate the ICBM in flight or coat the ICBM skin with the same kind of heat-absorbent material already used on reentry vehicles so that still higher levels of energy would be required to burn through the skin, requiring increases in laser power or in the mirror size of the laser weapon. Direct countermeasures against the space stations also might be possible, including space mines and anti-satellite satellites. The space-based laser perhaps would be most vulnerable to an attack by ground-based lasers.

Even if the technology development is successful beyond my expectations, the ultimate operational problems are a major concern. Whatever exotic technology we finally settle on, we must believe that, like every other weapon system, it will be subject to some countermeasures. And because of the measure-countermeasure contest, our defense system will have some variable level of effectiveness at any given time. In World War II, the best air defense systems achieved about 10 percent effectiveness. The program manager of the space-borne laser program has estimated that it might achieve 50 percent effectiveness. If by remarkable improvements in defense technology we were able to deploy an antiballistic missile system with 95 percent effectiveness and during this period the Soviets made no changes in their present force of ICBMs, they would still be able to place a residual force of 300 ICBM warheads on our cities, each of which was 30 times larger than the atomic bomb that devastated Hiroshima. Therefore, we would still want some *deterrence* in addition to our defense; that is, we would still want to maintain offensive nuclear forces to threaten retaliation. So, unless a defensive system were perfect—which is as unachievable as the perpetual motion machine—it would not replace offensive, retaliatory forces, only supplement them, and the task of maintaining that deterrent would be made immeasurably more difficult by the existence of a Soviet missile defense built to match ours.

This need for deterrence, not hoping for perfect defense, is the inevitable consequence of the enormous destructive force of the excessively large numbers of nuclear weapons possessed by both the Soviet Union and the United States. Maintaining our security through the threat of nuclear retaliation puts us in an agonizing uncomfortable position. If we could find a safe way out, we should seize it. But we should not delude ourselves. Pursuing the unattainable risks diversion from real priorities—better conventional defense (including using our technology as leverage), secure and stable retaliatory deterrence, and the search for arms control.

It has always been tempting to solve the problems posed by nuclear weapons by wishing them away. But we cannot uninvent the nuclear bomb—we cannot repeal $E=MC$.

[From the New York Times, Mar. 27, 1983]

100% DEFENSE? HARDLY.

(By George W. Rathjens and Jack Ruina¹)

CAMBRIDGE, MASS.—If President Reagan gets his way, we will soon embark on a major effort to develop an exotic and technologically innovative defense against nuclear attack—one that he suggests may be so effective as "to give us the means of rendering nuclear weapons impotent and obsolete." As former

¹ George W. Rathjens, professor of political science at the Massachusetts Institute of Technology, was deputy director of the Defense Department's Advanced Research Project Agency. Jack Ruina, professor of electrical engineering and computer science at MIT, was director of the agency.

scientific advisers for the Department of Defense, we have to wonder about the basis for such optimism.

"There Is No Defense." That was the title and conclusion of a remarkable paper published in 1948 by a distinguished physicist, Louis Ridenour—a key figure in the development of radar and later the Air Force's chief scientist. His thesis is valid still and seems virtually certain to remain so as far as we can see into the technological future—despite considerable progress in the technology for delivering and defending against nuclear weapons. This follows from the simple fact that thermonuclear weapons give us practically unlimited power of destruction, while cities and populations are extremely fragile. What this means is that a defense consistent with President Reagan's vision would have to be virtually 100 percent effective. Unfortunately, there can be little prospect of this, however exotic the means of destroying missiles or warheads—be it with particle beams or lasers.

These technologies pose intriguing scientific challenges, but developing such weapons would hardly achieve the President's goal of "eliminating the threat posed by strategic nuclear missiles." Much more would be needed: means for coping with the adversary's countermeasures, including discriminating between targets and other objects, means for protecting the antiballistic defense system itself and means for aiming beams, rays or projectiles. Most important, it would require coordinating all the components in a complex system that could defend not just a few isolated points but the whole country against attacks that might come at any time from any direction and that might include bombers, cruise missiles and ballistic missiles.

It is virtually certain that the Soviet Union would be able to offset our efforts by improving its offenses—and would probably be able to do so at a lesser cost. We are likely to see another round of competitive escalation—another example of what happened when Washington decided to develop and deploy thousands of nuclear-armed air-launched cruise missiles and a fleet of B-1 bombers in reaction to the Soviet Union's upgrading of its air defense. The antiballistic defense effort Mr. Reagan proposes is more likely to lead to intensification of the arms race than to pave the way for what he called "arms control measures to eliminate the weapons themselves."

Does this mean that we should forego research on such exotic systems? Probably not. It may even be possible to develop defensive systems that will be partly effective in defending a limited number of isolated targets—command-and-control facilities or other military targets. But this is a completely different and far less difficult problem than that of developing an essentially 100 percent effective defense of the nation's population.

What troubles us is less the expenditure of a billion dollars a year on research than holding out a vision of hope—the hope of an infallible defense—that is virtually impossible to achieve. It is not hard to understand why the Administration found this vision attractive—just as the fountain of youth or a universal cure for cancer is attractive—but it is cruel and misleading to hold out such false hopes.

There is also something deeply troubling about an advisory team that can encourage the President to raise such hopes—false hopes that have been resisted by recent predecessors, including Lyndon B. Johnson and Richard M. Nixon, when they made much more modest claims for the defenses they advocated in the late 1960's.

[The following material submitted by Senator Percy is related to the ABM Treaty and space-based BMD systems:]

EXCERPTS FROM SECRETARY OF STATE WILLIAM ROGERS' LETTER TRANSMITTING THE ABM TREATY TO PRESIDENT RICHARD NIXON (JUNE 1972)

LETTER OF SUBMITTAL

DEPARTMENT OF STATE,
Washington, June 10, 1972.

The PRESIDENT,
The White House.

THE PRESIDENT: I have the honor to submit to you the Treaty between the United States of America and the Union of Soviet Socialist Republics on the

Limitation of Anti-Ballistic Missile Systems (ABM Treaty) and the Interim Agreement between the United States of America and the Union of Soviet Socialist Republics on Certain Measures with respect to the Limitation of Strategic Offensive Arms (Interim Agreement), including an associated Protocol. It is my recommendation that the ABM Treaty be transmitted to the Senate for its advice and consent to ratification.

The Interim Agreement, as its title indicates, is an agreement limited in scope and time. It is designed to limit the aggregate number of intercontinental ballistic missile (ICBM) launchers and submarine-launched ballistic missile (SLBM) launchers, and the number of modern ballistic missile submarines, pending the negotiation of a treaty covering more complete limitations of strategic offensive arms. In these circumstances, I am submitting to you the Interim Agreement and its Protocol (which is an integral part of the Agreement), with the recommendation that they be transmitted to both Houses of Congress for approval by a Joint Resolution.

The Interim Agreement can by its terms enter into force only upon the exchange of written notices of acceptance by both countries and only when and if the ABM Treaty is brought into force. Both signatories understand that, pending ratification and acceptance, neither will take any action that would be prohibited by the ABM Treaty or the Interim Agreement and Protocol, in the absence of notification by either signatory of its intention not to proceed with ratification or acceptance.

ABM TREATY

In broad outline, the ABM Treaty, signed on May 26, 1972, provides that:

A nationwide ABM deployment, and a base for such deployment, are prohibited;

An ABM deployment for defense of an individual region is prohibited, except as specifically permitted;

Permitted ABM deployments will be limited to two widely separated deployment areas in each country—one for defense of the national capital, and the other for the defense of ICBMs;

For these purposes no more than 100 ABM launchers and no more than 100 ABM interceptor missiles at launch sites may be deployed within each 150-kilometer radius ABM deployment area, for a total of 200 deployed ABM interceptors and 200 deployed ABM launchers for each Party;

ABM radars will be strictly controlled; radars to support the ABM defense of the national capital may be deployed only in a specified number of small radar complexes within the ABM deployment area; radars to support the ICBM defense will be limited to a specified number within the ABM deployment area and will also be subject to qualitative constraint.

In order to assure the effectiveness of these basic provisions of the Treaty, a number of detailed corollary provisions were also agreed;

Development, testing and deployment of ABM systems or ABM components that are sea-based, air-based, space-based or mobile land-based are prohibited;

Deployment of ABM systems involving new types of basic components to perform the current functions of ABM launchers, interceptors or radars is prohibited;

The conversion or testing of other systems, such as air defense systems, or components thereof to perform an ABM role is prohibited.

* * * * *

Article II defines an ABM system as "a system to counter strategic ballistic missiles or their elements in flight trajectory". It indicates that such systems currently consist of ABM interceptor missiles, ABM launchers and ABM radars. ABM interceptor missiles are interceptor missiles constructed and deployed for an ABM role, or of a type hereafter tested in an ABM mode. ABM launchers are launchers constructed and deployed for launching ABM interceptor missiles. (A launcher associated with an interceptor missile that is hereafter tested in an ABM mode falls within the definition of an ABM launcher.) ABM radars are radars constructed and deployed for an ABM role (including target tracking or missile control, but not early warning), or of a type hereafter tested in an ABM mode.

The second paragraph of Article II makes it clear that the ABM system components listed in the first paragraph of the Article include not only those which are operational, but also those under construction, undergoing testing, undergoing overhaul, repair or conversion, or mothballed.

Article III prohibits the deployment of any ABM systems or their components except as provided therein. Under Article III, the Parties may deploy only systems consisting of ABM interceptor missiles, ABM launchers and ABM radars. The limited deployment of such systems described in the next two paragraphs below is permitted only (a) within one deployment area centered on the nation's capital and having a radius of 150 kilometers, and (b) within one other deployment area having the same radius and containing ICBM silo launchers. The centers of the two deployment areas will be separated by no less than 1,300 kilometers.

(1) Development, Testing, and Other Limitations

Article IV provides that the limitations in Article III shall not apply to ABM systems or ABM components used for development or testing, and located within current or additionally agreed test ranges. It is understood that ABM test ranges encompass the area within which ABM components are located for test purposes, and that nonphased-array radars of types used for range safety or instrumentation purposes may be located outside of ABM test ranges. Article IV further provides that each Party may have no more than a total of 15 ABM launchers at test ranges. The current United States test ranges for ABM systems are located at White Sands, New Mexico and Kwajalein Atoll in the Pacific. The current Soviet test range for ABM systems is located near Sary Shagan, Kazakhstan SSR. ABM components are not to be deployed at any other test ranges without prior agreement between the Parties.

Article V limits development and testing, as well as deployment, of certain types of ABM systems and components. Paragraph V(1) limits such activities to fixed, land-based ABM systems and components by prohibiting the development, testing or deployment of ABM systems or components which are sea-based, air-based, space-based, or mobile land-based. It is understood that the prohibitions on mobile ABM systems apply to ABM launchers and ABM radars which are not permanent fixed types.

Paragraph V(2) prohibits the development, testing, or deployment of ABM launchers for launching more than one ABM interceptor missile at a time from each launcher; modification of deployed launchers to provide them with such a capability; and the development, testing, or deployment of automatic or semi-automatic or other similar systems for rapid reload of ABM launchers. The Parties agree that this Article includes an obligation not to develop, test, or deploy ABM interceptor missiles with more than one independently guided warhead.

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(3) Future ABM Systems

A potential problem dealt with by the Treaty is that which would be created if an ABM system were developed in the future which did not consist of interceptor missiles, launchers and radars. The Treaty would not permit the deployment of such a system or of components thereof capable of substituting for ABM interceptor missiles, launchers, or radars: Article II(1) defines an ABM system in terms of its function as a "system to counter strategic ballistic missiles or their elements in flight trajectory", noting that such systems "currently" consist of ABM interceptor missiles, ABM launchers and ABM radars. Article III contains a prohibition on the deployment of ABM systems or their components except as specified therein, and it permits deployment only of ABM interceptor missiles, ABM launchers, and ABM radars. Devices other than ABM interceptor missiles, ABM launchers, or ABM radars could be used as adjuncts to an ABM system, provided that such devices were not capable of substituting for one or more of these components. Finally, in the course of the negotiations, the Parties specified that "In order to insure fulfillment of the obligation not to deploy ABM systems and their components except as provided in Article III of the Treaty, the Parties agree that in the event ABM systems based on other physical principles and including components capable of substituting for ABM interceptor missiles, ABM launchers, or ABM radars are created in the future, specific limitations on such systems and their components would be subject to discussion in accordance with Article XIII and agreement in accordance with Article XIV of the Treaty." (As explained below, Article XIII calls for establishment of a standing Consultative Commission, and Article XIV deals with amendments to the Treaty.)

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(2) *Standing Consultative Commission*

Article XIII provides that the Parties shall establish promptly a Standing Consultative Commission (hereafter referred to as the Commission) to promote the objectives and to facilitate the implementation of the ABM Treaty. The Parties have further agreed to use the Commission to promote the objectives and implementation of the Interim Agreement. (See Article VI of the Interim Agreement.) The Commission will provide a consulting framework within which the Parties may consider various matters relating to the Treaty and the Interim Agreement. The Parties may also consider these matters in other channels.

A principal function of the Commission will be to consider questions of compliance with the obligations assumed under this Treaty and the Interim Agreement and also related situations which may be considered ambiguous. Each Party may voluntarily provide through the Commission information it considers necessary to assure confidence in compliance. Thus one Party might raise a question of compliance based on information gathered by national technical means of verification and the other Party could provide information to clarify the matter.

Attention was called above to the provisions in Article XII prohibiting intentional interference with national technical means of verification operating in accordance with its provisions. The Commission is charged by Article XIII with the responsibility to consider any questions of interference with such means. The Commission may also consider questions of concealment impeding verification by national means. The Commission may consider changes in the general strategic situation which have a bearing on the provisions of the Treaty. Related to this is the Commission's authority to consider proposals to further increase the viability of the Treaty—such as agreed interpretations after the Treaty has entered into force—and to consider proposals for amendment of the Treaty. (Amendments to the Treaty would have to be ratified pursuant to Articles XIV and XVI.) The Commission may also consider other appropriate measures, not specifically enumerated in Article XIII, aimed at further limiting strategic arms. Finally, through the Commission the Parties are to agree on procedures and dates for the implementation of Article VIII concerning destruction or dismantling of ABM systems or ABM components. (For corresponding responsibility of the Commission under the Interim Agreement, see section C of the discussion thereof.)

The second paragraph of Article XIII provides for the establishment of regulations for the Commission governing procedures, composition and other relevant matters. Such matters can be worked out early in the follow-on negotiations. Meanwhile, any consultation desired by either side under these Articles can be carried out by the Delegations during such negotiations or, when they are not in session, through other diplomatic channels.

The Commission is intended as a means to facilitate the implementation of the agreements and would not replace follow-on negotiations or use of other diplomatic channels.

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D. DURATION, WITHDRAWAL AND FURTHER NEGOTIATIONS

Article XV provides that the Treaty shall be of unlimited duration, but contains a withdrawal clause of the type that has become standard in post-war arms control treaties. This clause provides that each Party in exercising its national sovereignty, shall have the right to withdraw from the Treaty if it decides that extraordinary events related to the subject matter of the Treaty have jeopardized its supreme interests. Notice of such decision is to be given to the other Party six months prior to withdrawal from the Treaty. Such notice is required to include a statement of the extraordinary events involved.

In this connection, the United States has stressed the unique relationship between limitations on offensive and defensive strategic arms. The interrelationship lends extraordinary importance to the undertaking in Article XI "to continue active negotiations for limitations on strategic offensive arms."

The special importance we attach to this relationship was reflected in the following formal statement relating to Article XI, which was made by the Head of the United States Delegation on May 9, 1972:

"The US Delegation has stressed the importance the US Government attaches to achieving agreement on more complete limitations on strategic offensive arms,

following agreement on an ABM Treaty and on an Interim Agreement on certain measures with respect to the limitation of strategic offensive arms. The US Delegation believes that an objective of the follow-on negotiations should be to constrain and reduce on a long-term basis threats to the survivability of our respective strategic retaliatory forces. The USSR Delegation has also indicated that the objective of SALT would remain unfulfilled without the achievement of an agreement providing for more complete limitations on strategic offensive arms. Both sides recognize that the initial agreements would be steps toward the achievement of more complete limitations on strategic arms. If an agreement providing for more complete strategic offensive arms limitations were not achieved within five years, US supreme interests could be jeopardized. Should that occur, it would constitute a basis for withdrawal from the ABM Treaty. The US does not wish to see such a situation occur, nor do we believe that the USSR does. It is because we wish to prevent such a situation that we emphasize the importance the US Government attaches to achievement of more complete limitations on strategic offensive arms. The US Executive will inform the Congress, in connection with Congressional consideration of the ABM Treaty and the Interim Agreement, of this statement of the US position."

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EXCERPT OF STATEMENT BY SECRETARY OF STATE WILLIAM ROGERS BEFORE THE
SENATE FOREIGN RELATIONS COMMITTEE (JUNE 1972)

OTHER IMPORTANT QUALITATIVE LIMITATIONS

The treaty provides for other important qualitative limitations. The parties will undertake not to develop, test or deploy ABM systems or components which are sea-based, air-based, space-based or mobile land-based. They have also agreed not to develop, test or deploy ABM launchers for launching more than one ABM interceptor missile at a time from each launcher; nor to modify launchers to provide them with such a capability; nor to develop, test or deploy automatic or semi-automatic or other similar systems for rapid reload of ABM launchers; nor to develop, test, or deploy ABM missiles with more than one independently guided warhead.

Perhaps of even greater importance as a qualitative limitation is that the parties have agreed that future exotic types of ABM systems, i.e. systems depending on such devices as lasers, may not be deployed, even in permitted areas.

One of the more important corollary provisions deals with prohibiting the upgrading of anti-aircraft systems, what has been called the "SAM-upgrade" problem. The conversion or testing of other systems, such as air-defense systems or components thereof, to perform an ABM role is prohibited as part of a general undertaking not to provide an ABM capability to non-ABM systems.

EXCERPT OF STATEMENT BY AMBASSADOR GERARD SMITH, BEFORE THE
SENATE ARMED SERVICES COMMITTEE (JUNE 28, 1972)

DEVELOPMENT DEFINED AS FIELD AND/OR PROTOTYPE TESTING LABORATORY RESEARCH
ON EXOTIC ABM SYSTEMS UNCONSTRAINED

Article V of the ABM Treaty and an Agreed Interpretive Statement (F) obligate the U.S. and USSR "not to develop, test, or deploy" mobile ABM systems rapid reload devices, or ABM interceptor missiles for delivery of more than one independently guided warhead.

The SALT negotiating history clearly supports the following interpretation. The obligation not to develop such systems, devices or warheads would be applicable only to that stage of development which follows laboratory development and testing. The prohibitions on development contained in the ABM Treaty would start at that part of the development process where field testing is initiated on either a prototype or breadboard model. It was understood by both sides that the prohibition on "development" applies to activities involved after a component moves from the laboratory development and testing stage to the

field testing stage, wherever performed. The fact that early stages of the development process, such as laboratory testing, would pose problems for verification by national technical means is an important consideration in reaching this definition. Exchanges with the Soviet Delegation made clear that this definition is also the Soviet interpretation of the term "development."

Consequently, there is adequate basis for the interpretation that development as used in Article V of the ABM Treaty and as applied to the budget categories in the DOD RDT&E program places no constraints on research and on those aspects of exploratory and advanced development which precede field testing. Engineering development would clearly be prohibited.

No. The Term "development" appearing in Article IV of the Treaty is used in the same sense as the term "develop" in Article V.

Senator PRESSLER. I will leave the record open, and I know that we will want to check with the other Senators to see if any of them have statements.

Senator PELL. I may have a few insertions to make, too.

Senator PRESSLER. The subcommittee is adjourned.

[Whereupon, at 4:35 p.m., the subcommittee adjourned, subject to the call of the Chair.]

CONTROLLING SPACE WEAPONS

WEDNESDAY, MAY 18, 1983

UNITED STATES SENATE,
COMMITTEE ON FOREIGN RELATIONS,
Washington, D.C.

The committee met, pursuant to notice, at 10:09 a.m., in room SD-419, Dirksen Senate Office Building, Hon. Larry Pressler presiding.

Present: Senators Percy, Pressler, Pell, and Tsongas.

The CHAIRMAN. Senator Pressler is a few minutes late, so we will get under way.

I want to commend Senator Pressler for his continued effort in bringing attention to the arms control implications of the space arms race and the very active work that the Subcommittee on Arms Control has had in this field. In this I share his view that before we engage in space arms competition we should give serious attention to the arms control option.

In my opinion, it is far from clear that the United States would benefit from a space arms race. It could be militarily destabilizing and will certainly cost a great deal of money. Even in the best of circumstances, a space arms competition is likely to take away tax dollars from other important military programs. Before we proceed with space arms programs, it is vitally important that the United States take a careful accounting of these concerns.

It is for this reason that I am a cosponsor of Senate Resolution 43, which urges the President to resume space arms control talks with the Soviet Union. Only through negotiations can we determine whether the Soviets would move away from public posturing on the space issue and toward serious negotiations. Only through talks now can we hope to stop the space arms race before it gets off the ground and beyond our control.

At the same time, let me say, until such time as we can produce an agreement which would ban space weaponry, we would be wise to continue our research activities. The Soviets have an active research program in the development of space weaponry. They alone have an operational antisatellite weapon. Our interests in arms control and security would not be served by ignoring this fact.

Only through an active research effort that is consistent with our obligation under the ABM Treaty can we hope to foreclose the risks of a destabilizing Soviet breakthrough. Let me note that Senate Resolution 43 is consistent with this position, for it allows such research as is allowed under the ABM Treaty.

Today we are fortunate to have with us Ambassador Kenneth Adelman and Fred Ikle, who will present the administration's view on space arms control and security policy. This will be our first occasion

to learn the details of the administration's thinking since President Reagan's March 23 address.

We are also fortunate to have with us a distinguished panel of experts, who under the auspices of the Union of Concerned Scientists have conducted an important study on the arms control implications of antisatellite weapons.

I wish to welcome these witnesses today. We are pleased to welcome Ken Adelman. This will be your first appearance before the committee since having been confirmed as ACDA Director. I want to compliment you very much for the very aggressive, progressive way that you have undertaken your duties.

There is a new spirit in ACDA and I compliment you also on the selection of the Deputy Director, who appeared yesterday before this committee and performed extremely well, as well as in our private discussions with him.

Senator Pressler, if I may, I will turn the hearing over to you. I, once again, commend you for your leadership in this field.

Senator PRESSLER [presiding]. This is the third in our series of hearings that we have held on space arms control. As I have previously stated, we are at the crossroads in the development of space policy.

The challenge posed by space weapons is only one aspect of the problem. In addition to the issues posed by a space weapons race, we have yet to learn to effectively manage other aspects of space technology. We currently face major decisions on the direction of our scientific and commercial space programs. Unless we learn to successfully direct these programs, we risk losing both the benefits of space technology and U.S. international leadership in this field.

Let me say that both this committee and the Commerce Committee have been looking at not only the military issues in outer space but also we have been looking at the commercial application of space technology, including the issues of who shall own the satellites and how we can protect those satellites upon which we are becoming increasingly dependent.

So it is not just an issue of military weapons in outer space or nuclear weapons, although it certainly is that, but it is a much broader concern as our society increasingly depends on space systems for everything down to telephone calls. My views on these broader issues are summarized in a Christian Science Monitor Op Ed piece. I ask that it appear at the conclusion of my remarks.

Today's hearing provides this committee with its first opportunity to hear from the administration on space weapons and arms control policy since President Reagan's speech on March 23. We are fortunate to have Kenneth Adelman with us. This is Mr. Adelman's first appearance before the committee since his confirmation. He will provide us with the arms control perspective on this important issue.

We are also fortunate to have Fred Ikle here today. Secretary Ikle will provide the Defense Department's views on strategic and arms control issues raised by the deployment of killer satellites and more advanced systems, such as the laser system, proposed by the President.

This hearing is timed to coincide with the conclusion of a major arms control study organized by the Union of Concerned Scientists.

Their report, to be released today, represents an important attempt to identify the implications of a space arms race with the Soviet Union. Three members of this panel are here to present their findings—Dr. Richard Garwin, Adm. Noel Gayler, and Dr. Kurt Gottfried. After we hear from this panel, we will hear testimony from Carol Rosin of the Institute for Security and Cooperation in Outer Space.

[The article referred to follows:]

[From *Christian Science Monitor*, Apr. 19, 1983]

HEADING OFF BAD SPACE POLICIES

(By Larry Pressler)¹

Recent events highlight the public's growing interest in outer space issues. Last July 4, the Space Shuttle Columbia ended its test phase and entered the transport business. In January, a Soviet nuclear-powered satellite plummeted to earth, threatening populated areas. In February, President Reagan moved to sell two satellite systems to COMSAT, and in March he announced plans to develop laser weapons that could be deployed in space. The laser program would be a follow-on to the U.S. anti-satellite weapon which is soon to be tested and deployed.

Such programs have a major impact on the public. The move toward space weapons is an expensive proposition and it could be militarily destabilizing. The General Accounting Office believes that the U.S. ASAT will cost "tens of billions" to deploy. Once we move toward exotic weapons such as lasers, costs will multiply significantly. One estimate suggests that the missile-killing platforms proposed by the President might cost several hundred billion dollars.

In proceeding toward space weapons we have far more to lose than to gain. Taxpayers are overburdened by defense costs. A huge space weapons program would increase defense spending even further. The U.S. depends heavily on a peaceful space environment, and a space arms race would make it more costly there. Growing business interest in space systems could decline. It is these long-term considerations that have been forgotten as the U.S. moves toward a space weapons race. Ultimately, it is the public that will have to pay for any mistakes made today.

As satellite technology matures, government should look to the private sector to manage a larger share of space activities. While this rule makes sense in general, we must assure that its specific application serves the public interest. At the present time, we face this dilemma with regard to the future of METSAT (meteorological weather satellites) and LANDSAT (land remote sensing satellites) programs. Decisions now under review by the administration could affect the lives of thousands of workers, billions in tax dollars, the balance of payments, and national security.

Since the administration's decision to "commercialize" our weather and land satellites, the proposal has come under close scrutiny. The numerous studies that address this issue arrive at similar conclusions. Commercialization now could cost the government more money than it currently spends; would create government-subsidized monopolies; decrease public service; lead to decreased employment; and create foreign relations and national security problems.

The evidence indicates that we are not yet ready to "commercialize" our land and weather satellites. Still, a decision to commercialize has been made. As someone who has been actively involved in this issue for years, I believe that a reassessment is in order. Unless there is some new and startling evidence that has escaped me, I will continue my fight against this transfer.

If the private sector could operate the satellites in a true free market atmosphere and continue to provide the same level of service, then we have an entirely different story. But I see none of those elements in any of the current proposals.

In communications, the U.S. has expanding commercial prospects and new systems ready to serve the public. But international institutes are blocking the way.

¹ Larry Pressler, Republican of South Dakota, works with the issues of space weapons and satellite communications as chairman of the Senate Foreign Relations Subcommittee on Arms Control and as a member of the Senate Commerce Subcommittee on Communications.

The International Telecommunications Union (ITU) determines orbital space assignments and spectrum allocations. However, recent ITU conferences have shifted from legitimate communications matters to a stalemated debate on extraneous issues, such as the Middle East. In the meantime, U.S. policymakers appear slow to develop a coordinated federal posture for these conferences. Failure to correct this situation will seriously weaken U.S. telecommunications leadership.

As a first order, the U.S. must restructure policymaking to assure that we speak with a single voice rather than the many one hears today. Absent a clear and coherent response and a concerted effort to work within existing or new organizations, we will deny our people the benefits that satellites offer today and remove incentives to lead this enterprise in the future.

In these three areas, a change of priorities is in order. The trend toward space weapons may entail risks and costs that are not in America's interest. Transferring METSAT and LANDSAT to the private sector makes little sense, for it could mean having to pay more for a good deal less. In making international arrangements, the ITU looks increasingly like the Law of the Sea negotiations, with some nations seeking a free ride on American shoulders. Failure to deal with these problems effective and forcefully today will damage American interests in the future. We as a nation must:

1. Develop a comprehensive policy for outer space communications and military activities.
2. Pursue these policies with full realization that every human being in our nation will be dramatically affected by space policies in the coming years.

Senator PRESSLER. Let me welcome all our witnesses, but first Senator Pell.

Senator PELL. Thank you, Mr. Chairman.

I join you today, too, in welcoming this opportunity to ascertain from Ambassador Adelman and Under Secretary Ikle whether the executive branch is prepared to take positive action to help avert the threat of an arms race in space. I also look forward to hearing from the panel organized by the Union of Concerned Scientists and from Ms. Carol Rosin, representing the Institute for Security and Cooperation in Outer Space.

During the hearings on Mr. Adelman's nomination, I came to share Senator Pressler's concern that the administration was not pursuing a productive course with regard to the control of antisatellite weapons. I believe the administration should open bilateral negotiations at the earliest date, so that we can have every opportunity to achieve agreement while it is still possible to put the necessary controls on anti-satellite weapons.

The second matter of great importance is the control of weapons in space. We fellow passengers of *Spaceship Earth* have the opportunity to advance now, if we possess the will. It would seem to me the draft treaty that the panel will propose today has merit and reflects a judicious approach. I hope the administration is open to serious consideration of the panel's proposal.

The current debate over the MX missile reminds us once again that weapons programs, once started, acquire a life of their own and are very hard to stop, even when the rationale for them has virtually vanished. We have seen that here. It is like the Hydra; it cannot be killed.

We do not want to have the same thing to happen with regard to space weapons. If we do not have control soon, there is no doubt in my mind that the situation will get out of hand and that we and the Soviet Union will develop and deploy a plethora of weapons that we do not need.

Weapons in space are an intriguing subject for comic book treatment, but they are not something to be treated lightly or capriciously when our whole national security can be put at risk by such weapons.

Thank you, Mr. Chairman.

Senator PRESSLER. Senator Tsongas.

Senator TSONGAS. Thank you, Mr. Chairman.

I welcome the Ambassador. It must be nice to have something else be an issue besides your confirmation. I took forward to working with you on these issues.

I have a prepared statement which I would like to have inserted in the record. I would just like to state at the outset that when we look back on this issue that 1983 will be the year in which we chose the road, whether that road be negotiations or whether that road be another chapter in the arms buildup. There are obviously problems of security and the nuclear confrontation aspects which we will get into, and my statement deals with that.

But I think also that there is a budgetary concern. The President said before the Homebuilders Association that the Democrats were to blame for the deficit, which I think got everyone's attention, at least on my side of the aisle. And here we are looking at a prospect of multibillion dollar—and some would argue even up to half a trillion dollar—expenditures. How much it is no one can say.

But if we are going to be concerned about spending, it seems to me that the least we can request is that an honest effort be made to negotiate out this segment of the arms race and not simply engage in it for its own sake. My own view, which I have discussed with you before, is that we have two fronts, if you will, to be concerned with.

One is the Soviet front; the other is the Japanese front. To the extent you maximize the input of both capital and engineers, your technical skills, in essence confronting the Soviet challenge, you minimize your capacity to meet the Japanese challenge to the rest of our industrial base.

So I think there are enormous domestic economic considerations in this issue as well, beyond the military, and even more implications, and I would hope that some time would be spent dealing with that.

I commend the chairman for taking a very obscure issue and trying to make the American public aware of the road down which we are going and look forward to your testimony.

Thank you, Mr. Chairman.

[Senator Tsongas' prepared statement follows:]

PREPARED STATEMENT OF HON. PAUL E. TSONGAS, A U.S. SENATOR FROM MASSACHUSETTS

Mr. Chairman, the subject of today's hearings, space-based weapons, is one of the most crucial military and political issues facing the world today.

I would like to comment first about antiballistic missile systems. In my view the Administration's recent and highly publicized emphasis on ABM weapons is based on false strategic premises, and steers the arms control debate in a direction that can only benefit the Soviet Union. I would like to make three points to explain my thinking.

First of all, it is clear that there is no such thing as a perfect safety net to defend against Soviet nuclear weapons. There is no such thing now, nor do the most optimistic technological projections suggest that there ever will be. Only a few nuclear weapons can cause fearsome damage. No safety net can guarantee that at least a few nuclear weapons—carried by ballistic missiles, bombers or some other means—could not slip through our defenses. There is, unfortunately, only

one way this country can deter such an attack: by maintaining the ability to inflict unacceptable damage on any potential aggressor.

I wish it were otherwise, but that is the reality.

Second, ABM weapons are not defensive; they are offensive. They only serve to protect the aggressor nation from retaliation. The 1972 ABM Treaty was the result of the American ability to convince the Soviets of this reality. The reason is simple: an ABM system can be countered by launching more missiles than it can handle. But to do this with the missiles remaining after a massive, counter-force first strike would be extremely difficult. That is, it is possible to defeat an ABM system as part of a first strike; it may be impossible to do so in a retaliatory strike. Thus, ABM systems are part of a first strike capability, and provide less deterrence than the ability to retaliate in kind.

Third, all our ABM talk and our lack of action on arms control are fueling the Soviet propaganda machine. Last month this committee heard testimony on the Geneva arms control negotiations. The testimony indicated that neither the START nor the INF negotiations is going anywhere.

Meanwhile, the popular movement for an end to the arms race grows here and in Europe. This propaganda war for the hearts and minds of the world is not going in our favor. While President Reagan hints at abrogating the ABM Treaty, Yuri Andropov is offering to negotiate a complete ban on weapons in space. As public opinion shifts in Western Europe and elsewhere, the Soviets may conclude that they can obtain U.S. arms concessions without negotiating. We may end up with either no agreements or ones overly favorable to the Soviet Union. We only worsen our position by leaving the high ground to the Kremlin.

If we want to give the Soviets the greatest incentive to stick to the ABM Treaty, we must continue research work on potential ABM technologies. Our research will keep the Soviets honest because they would know that should they develop and deploy an ABM system in violation of the treaty we could match them tit for tat. But we should not make it a top national priority to develop an ABM system, particularly as this may involve violating an arms control accord. The 1972 ABM Treaty expressly forbids development, testing and deployment of ABM systems based in space. Thus, even to test an ABM system is to imperil the arms control efforts that ought to be our highest priority.

The second issue this committee will address today concerns anti-satellite weapons. The issue here is no less acute. We are approaching a watershed. If the United States tests its anti-satellite weapon, as is planned for this fall, we will enter a new and more dangerous phase in the arms race. The ASAT system we are about to test may not be amenable to verification. The U.S. ASAT consists of a small homing missile launched from a high-flying F-15. An F-15 carrying such a weapon would be undistinguishable from any other F-15. The missile itself kills by directly ascending up to the satellite and colliding with it, and the overall system should be markedly superior to current Soviet systems. To test this system could seriously reduce chances for obtaining a verifiable restriction on anti-satellite weapons. On the other hand, unilateral action on our part can lead to disaster. The Soviets have been testing their crude, co-orbital ASAT since the late 1960's. While the tests have only been partially successful, the Soviets do have an operational ASAT system, and we do not. We cannot expect the Soviets to negotiate a ban on weapons in space if we pursue a course of either stopping our own development of such weapons or pursuing this development willy-nilly, irrespective of the consequences for arms control.

The lack of such an agreement would seriously imperil our national security. While the Soviet Union can depend upon land lines of communication in a European conflict, we would have to depend upon satellite communications. Already, 70 percent of American military communications travel via satellite. Moreover, our military satellites provide us with communications and intelligence, and are also vital for verifying Soviet arms control treaty compliance. The ability to destroy Soviet satellites will not deter the Soviets from destroying our vital satellites during time of war. Thus, in all respects, obtaining an effective, verifiable ban on weapons in space and weapons to be used against spacecraft is in our national interest.

Mr. Chairman, today's hearings are particularly important. They offer us the first opportunity to hear from the Administration on these matters since the President's Star Wars speech of March 23rd. We will also hear from a distinguished group of American scientists who share my concern over the potential hazards of an arms race in space. These hearings ought to put to rest once and for all some of the notions already offered by the Administration which have

the potential of leading us dangerously astray. I hope that these hearings will establish a foundation of sensible guidelines to help in preventing an arms race in space.

Senator PRESSLER. At this point we will hear from Ken Adelman.

**STATEMENT OF HON. KENNETH L. ADELMAN, DIRECTOR, ARMS
CONTROL AND DISARMAMENT AGENCY**

Mr. ADELMAN. Thank you, Mr. Chairman.

Mr. Chairman, it is a great pleasure for me to be back before the Senate Foreign Relations Committee today. I believe it is fair to say that I looked forward to this appearance more than to any other appearance before this or any other committee since last January.

I see the tremendous press attention that is given to this appearance and I can only presume it is for Under Secretary Ikle, who is going to follow me. That is also due to Senator Pressler's, as it has been said, insight and prescient nature into highlighting an issue that we may look back on and see its importance for these years.

As members of this committee know, I am eager to build a close working relationship with the members of this committee. As I explained the afternoon after I was confirmed, following a telephone conversation with nearly each member, I met privately with most members the following week for extensive discussions and I want to thank the three members that are here for their time, interest and attention, because I spent a good deal of time with each of you.

I appreciate this opportunity to discuss the complexities of space arms control, a subject which you raised, Senator Pressler, in the committee during the confirmation process. Arms control for outer space is a matter of great importance to me personally and to the administration. It is obviously of great importance to the committee as well.

Further arms control arrangements affecting outer space could, in time, play a key role in the continuing U.S. effort to reduce the risks of war and to achieve greater international stability. Last July, the President noted that the administration will continue to study space arms control options and will consider verifiable and equitable space arms control measures that would ban or otherwise limit testing and deployment of specific weapons, should these measures be compatible with U.S. national security.

Studies of arms control options for outer space continue, and I hope to quicken their pace and speed their results. However, this committee should be aware of the many difficult technical problems, including verification problems, that constitute fundamental obstacles to progress in this area. These obstacles were pointed out by my friend and predecessor, Gene Rostow, last September and such problems, to be frank with the committee, have not been overcome yet.

Looking at a broader context, space arms control has to be seen in the administration's overall approach to arms control. As you know and as we have discussed many times since January, the Reagan administration is strongly committed to achieving substantial, equitable and verifiable reductions in nuclear and conventional arsenals and the elimination of chemical weapons. This is reflected in the START, the INF, the MBFR, and the CD arenas.

The fact that the administration has found it difficult to move toward space arms control proposals thus far is testimony more to the complexity of the issues themselves than to the lack of commitment for a wide and deep arms control agenda.

I think, just looking over the horizon, that this administration's arms control agenda is quite extensive, and I feel it in ACDA. As you know and we do not need to review right now, there is a great deal of international law on outer space now—the Outer Space Treaty, the Charter of the United Nations, Limited Test Ban, the ABM Treaty, and the Environmental Modification Convention.

I mention these and put them in the testimony to make the point that it is not a case of starting out at zero with some kind of negotiations and agreements on weaponry in outer space. There is already on the books considerable, although I think everybody here would admit insufficient, agreements on this question. But at least we are starting off with a base of some accomplishment through arms control over the years.

I would like to clear up something that Senator Pressler mentioned during my confirmation hearing, and that is the U.S. position in the CD on these issues, because there is some confusion on that score. It was one of the rare points of confusion during the confirmation.

The possibility of further arms control measures affecting outer space has been an active topic of discussion in the United Nations in discussions I have participated in, and in sessions of the Committee on Disarmament for the past 2 years.

In 1981, the United States supported Resolution 36/97C at the U.N. General Assembly, which requested the CD to consider the question of negotiating further outer space arms control measures. This resolution was introduced in the United Nations and strongly supported by a number of our allies. We were a cosponsor.

Also during the 1981 General Assembly, the Soviet Union submitted a draft treaty that would ban the stationing of any weapons in outer space. That is the treaty, Mr. Chairman, that you wrote a letter in the New York Times about, very carefully analyzing the deficiencies thereof.

There was a U.N. resolution sponsored by the Soviet Union and its allies calling for CD negotiations on such a treaty, which also passed the General Assembly. The Soviet draft treaty did not define what the term "weapon" is and did not seriously address the complex questions of verification.

The United States did not support the Soviet bloc resolution, a point that you made, Senator Pressler, during the confirmation hearings. You were asking me why that switch—because we do not believe that we should embark on negotiations before several technical problems are resolved. We do believe that the area of space arms control merits detailed discussion in the CD and that these discussions could help solve some of the problems and open the way to future negotiations.

In the 1982 spring and summer sessions of the CD, the U.S. participated in further discussions on issues associated with outer space arms control. In the fall of 1982, the U.N. General Assembly passed a U.S.-supported resolution, again introduced by several of our allies, that requested the CD to continue its consideration of the question of negotiating further outer space arms control measures.

The General Assembly also passed a resolution sponsored by some nonaligned countries, and supported by the Soviet bloc, calling for immediate outer space negotiations in the CD. Discussions continued during the spring part of the 1983 CD session, and the U.S. delegation continued to play an active role in those discussions. We anticipate doing so again during the upcoming sessions of the Committee on Disarmament, but I have noted that many issues and uncertainties require further resolution before embarking on any negotiations, and I am sure we are going to discuss that in detail later on.

The prime procedural issue at the CD is how best to approach a serious examination of the highly complex legal and technical aspects of the current situation regarding arms control arrangements for outer space. These include utilization of outer space for a number of activities, which you mentioned, Senator Pressler—navigation, communication, and weather forecasting, as well as activities such as command and control of military forces, early warning of ballistic missile attack, general reconnaissance and stabilizing activities, although of a clearly military nature.

More in our concern is the vital role of satellites in monitoring compliance with arms control agreements, both current and prospective, that need to be reflected.

In light of this complicated situation, we believe that the establishment of a full-fledged subsidiary body or working group within the CD to discuss the issues was premature at that time and that the discussion was best pursued within the framework of the informal discussions of the committee, the CD, as a whole.

Interest in establishing a working group has been intense, however, and has included strong support for setting up a body on the part of our allies. The United States has indicated to the committee that we do not object in principle to a working group and have suggested that when the CD resumes its 1983 session next month consultations begin on both substantive issues involved in the establishment of a working group and on the mandate for that working group. We want to insure that, if established, it could usefully undertake a full discussion of the relevant issues.

The President's decision on defensive technologies—I need not quote what the President said; they are consistent with our principles under the ABM Treaty. He called for close consultation with our allies. It is a comprehensive, intensive effort to define the long-term research and development program to achieve the ultimate goal of eliminating the threat posed by strategic nuclear missiles.

This could pave the way for arms control measures to eliminate the weapons themselves. We seek neither military superiority or political advantage. This was the President's March 23 speech. Our only purpose, one all people share, is to search for ways to reduce the danger of nuclear war.

The President's initiative represents the first step on a very long journey, which he was very frank in admitting, that of eliminating the threat posed by offensive strategic missiles. I want to assure you that this step does not conflict with existing agreements or the START or INF negotiations in progress.

As the effort goes forward to determine the technical feasibility of eliminating the threat posed by ballistic missiles, we will be better

able to examine its arms control implications in general and its potential for contributing, together with arms control efforts, to the creation of a more stable strategic balance.

Some of the considerations associated with the possibilities for additional arms control for outer space which require us to move with special caution in this area, the President's criteria last July are equality, verifiability, and compatibility with U.S. national interests. I do not think any of us would disagree with any of the three of those essential criteria.

The verification problem which is central to all arms control is particularly difficult here because there is a potential risk that would be inherent in even a small number of undetected antisatellite weapons. The seriousness of these risks flows from the fact that there are a relatively small number of satellites that are most important to our security and our arms control efforts.

Difficult space arms control verification problems must be resolved before serious negotiations are undertaken. That may be a point of contention with the committee, but we can get into that later.

One example of such a problem is that of verifying effectively that the Soviets would have given up their own operational ASAT system under an ASAT agreement. The Soviet ASAT is a relatively small system which is fitted to a space booster. We do not know how many ASAT systems the Soviets have manufactured. It would be difficult to preclude the possibility of a covert supply of ASAT systems for use in a crisis.

A second example is the difficult problem of determining whether a satellite contains proscribed material. As to Soviet ASAT capabilities, as the chairman stated, they have had an operational capability since the early 1970's. It is the only nation on earth with an operational ASAT capability. It is an asymmetrical relationship and it becomes a serious obstacle to achieving an equitable space arms control agreement. Even were we to solve the problems of verification and showing that the Soviets eliminate their interceptor system under an ASAT agreement, we could not eliminate the decade of Soviet ASAT experience.

In the nonspecialized weapons, space arms control is complicated by the fact that a variety of weapons could potentially be used for attacks on satellites, including some weapons such as certain Soviet ABM interceptor missiles that are permitted under other arms control agreements.

On defense policy, there is a growing threat posed by the present and prospective Soviet satellites that are not themselves weapons but can be used in time of war to direct Soviet military forces against United States and allied forces. Space weapon agreements that limit the Soviet threat to U.S. satellites will likely limit U.S. ability to negate such threatening Soviet satellites. I am not saying that is an overriding concern, but it is a concern.

Thus, there is a dilemma as to whether arms control agreements that would restrict our ability to deal with such satellites are in our national security interest. We must balance the desire to limit threats to U.S. satellites against the desire to be able to take actions against Soviet satellites that could cost American lives in a situation short of all-out war.

The technology, as you have said, Senator Pressler, and as Senator Tsongas has made a point, throughout the last year or two I have been aware of it, that the rapidly evolving technology in this area and on so many other areas—the Atari kind of technology advancement—space technology is likewise evolving at a rapid rate and developments in this field have implications both for military use and for space arms control.

The President's initiative on defensive technologies is a potential example of such a change. We cannot at this time clearly judge the implications of those advances and future ones.

Other negotiations. The outer space environment is very important to Western security. Arms control for outer space cannot be isolated from our other arms control initiatives. As talked about a few minutes ago, we have had a series of proposals to the Soviet Union and their outcome will affect, in part because they relate to monitoring and verification, on how we do in this area.

Let me say, because I know how committed this committee is to ACDA as an institution, that ACDA has taken and will continue to take a leading role in attempting to resolve the problems of space arms control, as I have outlined. We have an active program of research on space arms control matters, the results of which I am reviewing right now.

Our research program has projects in progress that address many of the technical obstacles I have discussed, including the verification problems, space weapon technology questions, and evaluation of potential space arms control initiatives. One of these is with Harvard University.

I have taken two additional steps in this area since being confirmed, motivated in part by the importance members of this committee placed on space arms control during the confirmation hearings.

First, I have asked my staff to take a fresh look at the scope of present international space law, in particular to assess the adequacy of the coverage of current agreements regarding arms control and any differing interpretations among nations as to the meaning of their provisions. Such a review of the present situation seems to me an important preliminary to moving forward in this area, to find out where the gaps are in the existing international space law.

Second, I have asked them to look into possible arrangements that could limit the threat to U.S. satellites and to spell out for me both their potential problems and their potential benefits. I can assure you I will be looking at both sides of this equation very carefully.

In summation, Mr. Chairman, I see significant problems for space arms control, but I share the view that we need to carefully consider all possible practical steps in space arms control that would meet the key criteria of equality, verifiability and compatibility with our national security.

Again, I want to thank you for this opportunity for my first appearance before the committee as Director of ACDA. I look forward to frequent contact between us and I will be happy to answer your questions.

I am sorry to take so long on the statement. I usually do not, but I thought that because of the importance of the subject it is better to lay out the record so we can go from there.

[Mr. Adelman's prepared statement follows:]

PREPARED STATEMENT OF HON. KENNETH L. ADELMAN

INTRODUCTION

Mr. Chairman and Members of the Committee:

It is a great pleasure for me to be back before the Senate Foreign Relations Committee today. I believe it is fair to say that I looked forward to this appearance more than to any other appearance before any Committee since last January.

I am eager to build a close working relationship with Members of this distinguished Committee, as I explained the afternoon I was confirmed by the Senate. Following a telephone conversation with nearly each Committee Member that day, I met privately with most Members the following week for extensive discussions on arms control.

Mr. Chairman, allow me to use this, my first appearance before the Committee as Director of ACDA, to extend my deepest appreciation to you Mr. Chairman and to your colleagues for the considerable time and warm hospitality they have extended to me personally. The Members uniformly have expressed their determination to work closely with me in a bipartisan manner. I, in turn, pledge to do my utmost to proceed in a similar manner and to warrant the considerable faith and trust both the President and the United States Senate have bestowed on me.

Mr. Chairman, I appreciate this opportunity to discuss with you and with the Committee the complexities of space arms control, a subject which you raised in the Committee during the confirmation process.

Arms control for outer space is a matter of great importance to me personally and to the Administration; it is obviously of great importance to this Committee as well. Further arms control arrangements affecting outer space could, in time, play a key role in the continuing U.S. effort to reduce the risks of war and to achieve greater international stability.

Last July, the President noted that the Administration will continue to study space arms control options and will consider verifiable and equitable space arms control measures that would ban or otherwise limit testing and deployment of specific weapons, should those measures be compatible with U.S. national security.

Studies of arms control options for outer space continue, and I hope to quicken their pace and speed their results. However, there are difficult technical problems, including verification problems, that constitute fundamental obstacles to progress in this area. As my friend and predecessor, Director Eugene Rostow, said last September "the military implications of scientific and technological developments for outer space, and the implications as well of Soviet space programs, present a series of daunting problems." These daunting problems have not been resolved, and we should not rush into negotiations on these subjects unless we are ready with verifiable proposals that will enhance national security.

I would like to review briefly: the role of space arms control in the Administration's arms control agenda; some international legal considerations; the status of ongoing international discussion of space arms control; the implications of the President's decision to pursue research on defensive technologies for space arms control; and factors that affect the prospects for meaningful progress in their area.

THE BROADER CONTEXT

First, to place space arms control into the context of the Administration's overall approach to arms control. As you know, Mr. Chairman, the Reagan Administration is strongly committed to achieving substantial, equitable and verifiable reductions in nuclear and conventional arsenals and the elimination of chemical weapons. This is reflected, for example, in our proposals in the START, INF and MBFR talks, and in U.S. proposals for negotiation of a verifiable chemical weapons ban in the CD. In all these areas and in all these arenas the United States has moved forward, after most careful preparation, with significant proposals. The fact that this Administration has found it difficult to move forward with space arms control proposals thus far is testimony to the complexity of space arms control issues.

EXISTING INTERNATIONAL SPACE LAW

Mr. Chairman, to review the existing situation with regard to international space law: the United States is a party to a number of bilateral and multilateral treaties, including the U.N. Charter, that bear upon military activities in outer space.

First, the Outer Space Treaty, among other things, prohibits the placement of nuclear weapons or any other weapons of mass destruction in Earth orbit, the installation of such weapons on celestial bodies, and the stationing of such weapons in outer space in any other manner.

Second, the Charter of the United Nations includes two provisions germane to outer space. The first of these is Article 2 (4), which provides that states may not in their international relations use force or the threat of force against the territorial integrity or the political independence of any state, or in any other manner inconsistent with the purposes of the United Nations. The second is Article 51 which provides that nothing in the Charter shall impair the inherent right of individual or collective self-defense. These provisions are specifically applied to outer space by the Outer Space Treaty. In effect, the first provision prohibits attack or threats of attack on satellites; the second assures the right to take defensive actions if U.S. satellites are attacked.

Third, the Limited Test Ban Treaty prohibits nuclear weapon test explosions or any other nuclear explosions in the atmosphere, in outer space, or under water.

Fourth, the Anti-Ballistic Missile (ABM) Treaty prohibits development, testing, or deployment of space-based ABM systems and their components. It and several other arms control agreements with the U.S.S.R. prohibit interference with national technical means of verification, which include satellites.

Fifth, the Environmental Modification Convention prohibits military or other hostile use of environmental modification techniques having widespread, long-lasting, or severe effects as the means of destruction, damage, or injury to any other State Party. Outer space is specifically included within the scope of the environments to which the Convention applies.

All U.S. space programs are in full compliance with these obligations, and all will remain so.

RECENT INTERNATIONAL SPACE ARMS CONTROL DISCUSSIONS

The possibility of further arms control measures affecting outer space has been an active topic of discussion in the United Nations and in sessions of the Committee on Disarmament (CD) for the past 2 years. In 1981 the United States supported Resolution 36/97C at the U.N. General Assembly, which requested the CD to consider the question of negotiating further outer space arms control measures. This resolution was introduced in the U.N. and strongly supported by a number of our Allies.

Also during the 1981 General Assembly, the Soviet Union submitted a draft treaty that would ban the stationing of any weapons in outer space. A U.N. Resolution sponsored by the Soviet Union and its Allies, calling for CD negotiations on such a treaty, also passed the General Assembly. The Soviet draft treaty did not define the term "weapon," and did not seriously address the complex questions of verification.

The United States did not support the Soviet bloc resolution because we do not believe we should embark on negotiations before several key technical problems are resolved. We do, however, believe that the area of space arms control merits detailed discussion in the CD, and that such discussion could help solve some of these problems and open the way to future negotiations. In the 1982 spring and summer session of the CD, the United States participated in further discussions on issues associated with outer space arms control.

In the fall of 1982, the U.N. General Assembly passed a United States-supported resolution, introduced by several of our Allies, that requested the CD to continue its consideration of the question of negotiating further outer space arms control measures. The General Assembly also passed a resolution sponsored by some non-aligned nations, and supported by the Soviet bloc, calling for immediate outer space negotiations in the CD. Discussions continued during the spring part of the 1983 CD session and the U.S. Delegation continued to play an active role. We anticipate doing so again during upcoming sessions of the CD; but, as I have noted, many issues and uncertainties require further resolution prior to embarking on any negotiations.

The prime procedural issue at the CD is how best to approach a serious examination of the highly complex legal and technical aspects of the current situation regarding arms control arrangements for outer space. These include utilization of outer space for a number of activities having both civil and military utility, such as navigation, communication, and weather forecasting, as well as activities, such as command and control of military forces, early warning of ballistic missile attack and general reconnaissance, that are, by and large, stabilizing activities, although of a clearly military nature. The vital role of satellites in monitoring compliance with arms control agreements, both current and prospective, also needs to be reflected.

In light of this complicated situation, we have believed that the establishment of a full-fledged subsidiary body, or working group, within the CD to discuss the issues was premature, and that the discussion was best pursued within the framework of informal discussions of the Committee as a whole. Interest in establishing a working group has been intense, however, and has included strong support for setting up such a body on the part of our Allies represented in the Committee. The United States has indicated to the Committee that we do not object in principle to a working group, and have suggested that, when the CD resumes its 1983 session next month, consultations begin on both substantive issues involved in the establishment of a working group and on its mandate. We will want to ensure that, if established, it could usefully undertake a full discussion of the relevant issues.

THE PRESIDENT'S DECISION ON DEFENSIVE TECHNOLOGIES

On March 23, the President announced a new effort to pursue the goal of defensive technologies. He said that: "consistent with our obligations under the ABM Treaty and recognizing the need for close consultation with our Allies, I am taking an important first step. I am directing a comprehensive and intensive effort to define a long-term research and development program to begin to achieve our ultimate goal of eliminating the threat posed by strategic nuclear missiles. This could pave the way for arms control measures to eliminate the weapons themselves. We seek neither military superiority nor political advantage. Our only purpose—one all people share—is to search for ways to reduce the danger of nuclear war."

The President's initiative represents a first step on a very long journey—that of eliminating the threat posed by offensive strategic missiles. I want to assure you that this step does not conflict with existing agreements or the START or INF negotiations in progress. As the effort goes forward to determine the technical feasibility of eliminating the threat posed by ballistic missiles, we will be better able to examine its arms control implications, in general, and its potential for contributing, together with arms control efforts, to the creation of a more stable strategic balance.

PROSPECTS

I would now like to turn to some of the key considerations associated with the possibilities for additional arms control for outer space which require us to move with special caution in this area. To begin, let me recall the essential criteria the President has listed for a space arms control proposal: equality, verifiability and compatibility with U.S. national security. There are several reasons why it is not a simple task to formulate such proposals. These include:

Verification.—Effective verification is central to all arms control. It can be particularly important here in view, for example, of the potential risk that would be inherent in even a small number of undetected antisatellite weapons. The seriousness of this risk flows from the fact that there are a relatively small number of satellites that are most important to United States and Allied security. Difficult space arms control verification problems must be resolved before serious negotiations are undertaken. One example of such a problem is that of verifying effectively that the Soviets would have given up their own operational ASAT system under an ASAT agreement. The Soviet ASAT is a relatively small system which is fitted to a space booster. We do not know how many ASAT systems the Soviets have manufactured. It would be difficult to preclude the possibility of a covert supply of ASAT systems for use in a crisis. A second example is the difficult problem of determining whether a satellite contains proscribed material.

Soviet ASAT capabilities.—The Soviet Union has been conducting space tests of its ASAT interceptor system for more than a decade and is judged to have an operational capability. It is currently the only nation with such a capability.

This asymmetry is a serious obstacle to achieving an equitable space arms control agreement. Even were we to solve the problem of verifying Soviet elimination of their interceptor system under an ASAT agreement we could not eliminate the decade of Soviet ASAT experience.

Nonspecialized weapons.—Space arms control is complicated by the fact that a variety of weapons could potentially be used for attacks on satellites, including some weapons, such as certain Soviet ABM interceptor missiles, that are permitted under other arms control agreements.

Defense policy.—There is a growing threat posed by present and prospective Soviet satellites that are not themselves weapons, but can be used in time of war to direct Soviet military forces against United States and Allied forces. Space weapon agreements that limit the Soviet threat to U.S. satellites will likely limit U.S. ability to negate such threatening Soviet satellites. Thus, there is a dilemma as to whether arms control agreements that would restrict our ability to deal with such satellites are in our national security interest. We must balance the desire to limit threats to U.S. satellites against the desire to be able to take actions against Soviet satellites that could cost American lives in situations far short of all-out war.

Technology.—Space technology is evolving at a rapid rate and developments in this field have implications both for military use of space and for space arms control. The President's initiative on defensive technologies is a potential example of such change. At this time, however, we cannot clearly judge the implications of those advances and future ones for our security and strategic stability.

Other negotiations.—The outer space environment is very important to Western security. Accordingly, arms control for outer space cannot be considered in isolation from other United States and Allied arms control initiatives. President Reagan has made a series of arms control proposals to the Soviet Union. Their outcome will have profound effects on our security, on the demands we place on our satellites, and on the structure of measures we would be willing to accept under space arms control limitations.

In addition to addressing such issues, the Administration will continue to consult closely on these issues with our Allies, and to support discussion of space arms control in the Committee on Disarmament in Geneva.

ACDA has taken, and will continue to take, a leading role in attempting to resolve the problems of space arms control I have outlined. ACDA has, for example, an active program of research on space arms control matters. It has projects in progress that address many of the technical obstacles I discussed, including verification problems, space weapon technology questions, and evaluation of potential space arms control initiatives.

I have taken two additional steps in this area since being confirmed—motivated in part by the stress Members of this Committee placed on space arms control during the confirmation hearings. First, I have asked my staff to take a fresh look at the scope of present international space law, in particular to assess the adequacy of the coverage of current agreements regarding arms control, and any differing interpretations among nations as to the meaning of their provisions. Such a review of the present situation seems to me an important preliminary to moving forward in this area. Second, I have asked them to look into possible arrangements that could limit the threat to U.S. satellites and to spell out for me both their potential problems and their potential benefits. I can assure you I will be looking at both sides of this equation very carefully.

In summation Mr. Chairman, I see significant problems for space arms control but I share the view that we need to carefully consider all possible practical steps in space arms control that would meet the key criteria of equality, verifiability, and compatibility with our national security.

Again, I thank you for this opportunity to appear before the Senate Foreign Relations Committee and I look forward to frequent contact between us.

I will be pleased to answer your questions and will look to the Committee for counsel and guidance in this critical area.

Senator PRESSLER. Thank you very much.

I have a few questions, but let me first say that we are dealing with a broad family of activities, of which the military aspects are perhaps the most important and perhaps the most pressing, but we also have the commercial aspects. Increasing numbers of groups, companies, and

governments putting up satellites for everything from exploring for oil to communicating, to crops forecasting and so forth.

But in the next 10 to 15 years, we are going to be more and more dependent on communication satellites and satellites used for large numbers of activities, other than military. I know this is not the purpose of this hearing but at some point we are going to have to protect them or have security for them, or have it assured that they can operate securely.

So, therefore, these commercial issues are related and this is not as some people think; just a military question. The purpose of this hearing, of course, is more on the military side but we must also keep in mind the large concept of where we are going in outer space. Whether we are speaking of lasers, ASATs or whatever, it has been my strongest conviction that we have not done enough thinking and planning for this era, which is probably going to be very expensive if we let a space arms race get out of hand.

Let me say that I have been an advocate, as you pointed out, a very strong advocate, of getting back to talking with the Soviets. I was delighted yesterday to hear that we are going to reopen talks on grain with the Soviet Union. I think these talks can have an arms control purpose and implication, because I think grain agreements can be a sweetener for an arms control agreement.

I think we are entering the beginning of a new time with the Soviet Union, and I do not say that with any naivete. I recently wrote a letter to the New York Times—in fact, on May 8—in which I criticized Andropov's space weapons treaty proposal because the Soviets have had an ASAT up for 15 years and have continued to test and experiment with ASATs. I ask that it be printed in the hearing record.¹

I should point out although I am a great advocate of reopening the talks with the Soviet Union on weapons in outer space that realistically if we were to freeze things as they are, the Soviets would be well ahead of us. We must reverse deployment to date.

A number of distinguished specialists wrote to Andropov on this issue of arms control in space. In his response he made no mention of Moscow's current ASAT, which has been in operation for 15 years and which the Soviets continue to test. Last June, for instance, this weapon was tested, together with land- and sea-based ballistic missiles, Soviet ABM capabilities, and SS-20 rockets.

Now, some analysts have interpreted this test as indicating the Soviets view ASATs as an important element in fighting a nuclear war. But Mr. Andropov's proposed treaty would allow the Soviet Union to retain this deadly system since it is deployed on the ground. The treaty only applies to space-based weapons.

So the point I am making is that I think there is blame on both sides in this matter, but if we do not get it resolved we are going to find ourselves spending, in my view, between \$200 billion and \$300 billion a year in an arms race in outer space, that will be far more expensive than anything we have seen on Earth, and ... dangerous.

Some believe that we can have a laser system that will make us completely safe against incoming weapons. I guess that is like the old days when the U.S. marshall's got the six-shooter out West. The Peacemaker

¹ See page 87.

was the most advanced gun and it was going to really bring the outlaws to an end. And, of course, it was replaced shortly thereafter by something more advanced.

So the point I am making is that mankind is about to enter into probably the most expensive arms race in history. We are right on the brink of it, perhaps already, we are into it and nobody seems to be paying any attention. I have seen some cost estimates for space weaponry. I have looked at some figures and have done some research and my staff has. I can say that when we get into the arms race in outer space it is going to cost us at least \$200 billion or \$300 billion a year, which is equal to the cost of our entire military operation.

So we potentially could have an impoverished Earth supporting the sophisticated weapons in outer space. That is the reason I have been quite concerned about these developments. I know it is not an issue a lot of people are very interested in or think is very immediately upon us, but I predict that 10 years from today, if we do not do something now, we are going to be in an arms race in outer space that is much more expensive and dangerous than anything we have seen to this point on the face of the Earth.

That being said, I was glad to hear you say that you have directed some internal studies. Last year I introduced an amendment that was passed. It authorized ACDA to conduct an intensive research effort on space arms control issues, and obviously you are doing that and have been doing it.

You have listed some activities that you are doing, and I thank you for that. How many specialists at ACDA are now working on space arms control issues?

[The following information was referred to on p. 86.]

[From the New York Times, May 8, 1983]

LETTERS: THE HOLE IN ANDROPOV'S SPACE-WEAPONS TREATY

To the Editor:

I noted with interest your recent news article [April 28] about Yuri V. Andropov's letter to a group of American space and military specialists who favor banning a race in space weaponry. I believe it is important to take a critical look at what the Soviet leader has offered.

Mr. Andropov states that he wishes to ban space-based weapons, and he notes that the Soviets have offered a draft treaty on this subject to the United Nations. He places blame for the failure to ban space armaments on the resistance of the U.S. and other members of NATO.

Unfortunately, the statement is a distortion of the facts, and Mr. Andropov's well-publicized letter seems designed to gain propaganda points rather than to grapple with the serious problems posed by space weaponry.

The statement and the draft treaty that it touts are documents of convenience: the treaty has a loophole large enough to fire the Soviet anti-satellite (ASAT) weapon through.

Mr. Andropov makes no mention of Moscow's current ASAT, which has been in operation for 15 years and which the Soviets continue to test. Last June, for instance, this weapon was tested together with land- and sea-based ballistic missiles, Soviet ABM capabilities and an SS-20 rocket.

Some observers have interpreted this test as indicating that the Soviets view ASAT's as an important element in fighting a nuclear war. Mr. Andropov's treaty would allow the Soviet Union to retain this deadly system since it is deployed on the ground. The treaty only applies to space-based weapons.

Moreover, the treaty implicitly speaks of the right to interfere with certain space systems. Some believe that this provision could be used to justify attacks on any space systems which the Soviets unilaterally declare to be hostile.

They have already targeted their propaganda on the U.S. space shuttle. Would the treaty allow them to target it with their ASAT? Also, concern has been expressed that the Soviets would use this provision to justify interference with direct-broadcast satellites if the broadcasts that utilize them fail to echo Moscow's line.

The Soviet treaty and the Andropov letter try to make political points with the U.S. and world opinion instead of dealing with the very serious challenge posed by an arms race in space. This is an important subject for immediate negotiation—a view I have expressed repeatedly in hearings that I have chaired and at the Adelman confirmation hearing. But until the Soviets forsake their current desire for unilateral coverage, there is little prospect for agreement.

A serious accord must deal with the Soviet ASAT, for which the U.S. currently has no equivalent. It would require stringent verification, which is not adequately addressed in the Soviet draft accord.

I believe that Senate Resolution 43, which I and eight co-sponsors have offered, presents an approach that is more likely to prevent a space arms race since it deals with these important considerations.

(Senator) LARRY PRESSLER.

Washington, May 2, 1983.

(The writer is chairman of the Senate Arms Control Subcommittee.)

Mr. ADELMAN. Before I respond to that question, let me respond to several things you said before, Mr. Chairman. I know that when you were reviewing the importance of precluding a weapons race in outer space you mentioned the commercial and the military value, and I know you did not want to have any oversight of the arms control value. I just want to make sure that we include in the record that it is hard to conceive of many successful arms control treaties with adequate verification provisions without satellite technology coming into play.

For the future of arms control, about which I am obviously concerned, preserving the capability of those satellites is essential to our business, and I know that you feel strongly about it as chairman of the Arms Control Subcommittee and I wanted to say that that is the third leg of our considerations besides commercial and military for our little bailiwick.

On arms control itself, we have an office in ACDA that has the competent technicians there. As I have said, we have research programs of a considerable amount of money that look at outer space verification provisions, outer space possibilities of the technical questions, and so a lot of that kind of work is contracted out.

Senator PRESSLER. Do you feel that the Soviets' and the United State's willingness to enter into a grain agreement and to open talks in London, might have arms control implications?

Mr. ADELMAN. I think whenever the United States and Soviet Union talk about concrete issues that there is a spinoff—how much of a spinoff is in dispute, but some spinoff—into other areas. I know that there has been a perception that this administration has not engaged in productive talks with the Soviet Union, or those kind of talks have been less in this administration than before.

I have never found that a particularly convincing argument because I know that in the arms control area there are continual sessions with the Soviet Union. Maybe I never got too credible—I never thought that the argument had much credibility to it because in my position at the United Nations we were constantly talking to the Soviets, and I could see that in the Geneva accords, in our respective embassies in Moscow and Washington, at the Secretary of State level, et cetera.

So I would answer your question by saying that when there are occasions, and profitable occasions, for the two of us to discuss issues like grain, there can be a spillover.

Senator PRESSLER. When I was in Moscow I met with Victor Karpov, who I know is a very articulate Russian and is one of their leading arms control specialists—whatever he said to me could well be construed as perhaps propaganda in part. But he said that they would be very happy to enter into an agreement that would ban weapons in outer space.

Do you believe this is true?

Mr. ADELMAN. I believe it to the extent of your letter to the New York Times, that the Soviet Union has grand, sweeping proposals on arms control and disarmament that sound appealing because they are simple, and they are fetching because they are so simple—complete disarmament and on and on and on.

The question you have to ask is, Is that a serious approach to arms control or is it just a propagandistic approach to arms control and a 1-day splash without much meat to it? I would conclude, as you concluded in your letter, that that kind of thing is not very helpful.

Senator PRESSLER. In the late 1960's several Senators warned that MIRVed deployment would produce only short-term benefits and long-term liabilities. The Scowcroft Commission has concluded that the liabilities are with us and we could achieve greater security by moving away from multiple warhead missiles. Similar warnings are now being issued with regard to deployment of ASATs.

First of all, in your view are ASATs likely to become the MIRV of the 1980's, and, second, do you believe that the United States should seek a ban on space weaponry before the F-15 ASAT is deployed?

Mr. ADELMAN. I believe it is very difficult to tell what kind of weapons in R&D today are going to put us in a situation that causes a great deal of trouble down the road. I admit to you, and I think in general people would admit, that the process of MIRVing, meaning putting a large number of warheads on one single missile and creating more valuable aim-point targets, was a mistake in the strategic nuclear development on both sides.

Now this was not a mistake that was unpredictable, just like we are talking about ASAT capabilities today. It was a mistake that was, in some measure, foreseen. In the early 1970's we approached the Soviet Union in the SALT talks about banning those kinds of weapons. There were conditions on that in the sense of various verification techniques we wanted at that time, but it was not an issue that was unaddressed in SALT.

You can say we should have done it more, we should have done it differently, and those are valid arguments. But it is not an issue that has never totally come up in the arms control field. In the ASAT capabilities, I would think that if you could get a situation where both sides would agree and have verification that they would not have the ASAT capability, that would be a better situation to be in.

Senator PRESSLER. OK. I see I have a redlight, so we will rotate back and forth. I have many more questions, but, Paul, please go ahead.

Senator TSONGAS. Mr. Ambassador, you raised the verification issue, which gets more difficult across the board as time goes on because of

the size of the systems. I have a picture here in Aviation Week of the ASAT carried by the F-15. I do not know how you verify that kind of thing.

Let me list six areas of negotiations and ask you to list the difficulty of verification—Threshold Test Ban Treaty [TTBT], which we have discussed before; the Peaceful Nuclear Explosions [PNE] Treaty; SALT II; INF; START; and ASAT. In terms of the difficulty of verification, how would you rank those six initiatives?

Mr. ADELMAN. On INF and START we just cannot say because what we are doing now is negotiating a treaty that is more verifiable than other treaties we have been involved in in the past. That is an evolving process and hopefully, if we do our job well, those will be Nos. 1 and 2 on the list and we can have an arms control agreement that is fully verifiable and does not create the kind of problems that we have.

The TTBT, the PNE, SALT II, ASAT you do not know either because we do not have a treaty, and to say that there are verification problems that need to be worked out, need to be thought out—not worked out—before entering into a negotiation at that time I think is a legitimate kind of concern.

So on ASAT you just do not know because there is no proposal around to put in our list of standing. On SALT II there were problems of verification. Unlike Senator Glenn, during the SALT II debate I did not think they were the overriding considerations. I know Senator Glenn did, and others, just wanted to vote no on the treaty because of those verification provisions.

I had problems with SALT II, as we discussed in this committee, because of the excessive nature of the limits in that agreement. The fact is that we are both living under roughly the terms of SALT II and building up. To have an arms control agreement that does not limit weapons on both sides but legitimizes arms buildup on both sides I do not think is a wise action.

On the TTBT and the PNE, as I have discussed many times with this committee, we have a record of results on that, on the 150-kiloton level, and we have techniques that we do not think would be excessively intrusive to really improve the verifiability of those agreements.

I guess, Senator Tsongas, to answer your question in a more philosophical vein, you have to ask yourself is it better for the United States and Soviet Union to enter into an agreement that may create all kinds of problems in the future, or is it better to iron out those problems before you enter into an agreement.

My general approach to arms control is that arms control is supposed to help stability in the world and it is supposed to help East-West relations. If it becomes another sore point between the countries, then it is doing the opposite of what it is intended to do.

Senator TSONGAS. Let me ask my question this way. The Threshold Test Ban Treaty and the PNE were held up. Now the Threshold Test Ban Treaty, I think, is 1974.

Mr. ADELMAN. That is right.

Senator TSONGAS. That has been on the books for 9 years now, and the problem is verification. The PNE has been on the books since 1976, so that is 7 years old. If the verification problems of those are easier to resolve than ASAT, then the prospects for ASAT are de minimus.

If it takes 7 to 9 years, at best, to work out easy verification problems, relatively speaking, how long is it going to take to work out ASAT verification problems, which, as we see by this picture, would suggest that they are much more difficult? And where will we be, let us say, 25 years from now when we have figured out how to solve the problem?

Mr. ADELMAN. That is a good consideration. The fact is that the TTBT and the PNE have been around since 1974 and 1976. The fact is that during the Carter administration there was not ratification of those two agreements. The fact is that the Reagan administration looked at those agreements and solely because of the verification problems that we do not think are difficult to solve—that, I guess, is the difference with the ASAT.

We have techniques that we believe would not be excessively intrusive, that would eliminate or at least reduce the chances that this would become another area of friction between the United States and the Soviet Union. I would not want to get in the situation where when foreign ministers and secretaries of state talk not only do they talk about the usual political, geographical kinds of issues of southern Africa and the Middle East or Central America, Poland, Afghanistan, but also bring up TTBT and PNE, because we have reservations on their compliance on that, like we do on the Biological Weapons Convention today.

Senator TSONGAS. You have gone back to the Soviets to seek renegotiations on the verification issue. They have said no; listen, we have negotiated this thing a long time ago, we are not going to go through it again. What is your position now? Do you think we should ratify and deal with verification subsequently, or do we hold it in abeyance?

Mr. ADELMAN. I believe that we should really sound out the Soviets on exactly what they are willing to do. If they are willing to absolutely close that door and do nothing and eliminate that possibility, then ask yourself and present to the President the alternative of (a) entering into and ratifying these two treaties that might create verification problems in the future, and problems between the United States and the Soviet Union, maybe leaving future Presidents with a situation like we are in with the Biological Weapons Convention, or (b) the risks of having that sore point are less than the benefits you would get from ratifying the treaties.

Senator TSONGAS. And your position is which of those two?

Mr. ADELMAN. As it stands now, I would say that it would be a disservice to future administrations to allow for the degree of unreliability on the verification right now that would hand a future President a whole lot of problems that a future President just does not need. It probably would not affect this administration, but future administrations.

Senator TSONGAS. So much for those two.

Mr. ADELMAN. Let me ask you, Senator Tsongas, if I could, these treaties have been around a long time. How come during the Democratic years there was never any ratification?

Senator TSONGAS. Well, I will try to arrange a flight to Plains and allow you to discuss it with the person who decided.

Mr. ADELMAN. I mean, the Senate has been free for almost 10 years to ratify. It was not started in 1981.

Senator TSONGAS. No. I do not have Jimmy Carter in front of me. I have you in front of me. If he were in front of me I would ask him the same thing.

What I am interested in is I think you have more control over arms control at this point than he does. You probably have more control over a lot of things today than he does, but that is another matter.

According to the article in Aviation Week—and I will read it:

First firing from an F-15 is planned for late summer and will involve two propulsion stages without the miniature vehicle. The second firing, planned for about October, would be the first to carry the miniature vehicle, but no target would be attacked. The first test against an AVCO satellite balloon target is planned by early 1984.

Is that schedule correct?

Mr. ADELMAN. Secretary Ikle could answer on the present plans for the deployment of the system.

Senator TSONGAS. Have you been given any veto over that testing?

Mr. ADELMAN. We have been in contact—ACDA and the Defense Department.

Senator TSONGAS. But does ACDA have a veto over the testing of the ASAT?

Mr. ADELMAN. We work together with counterparts at the Department of Defense and I am in constant contact, as you could suspect, with a lot of my colleagues in the Department of State and Defense on these issues.

Senator TSONGAS. But do you have a veto?

Mr. ADELMAN. I do not think anybody has a veto per se. If we feel strongly on an issue like that and we take it to the President, he would decide.

Senator TSONGAS. My time is up, but I have a couple more questions.

Senator PRESSLER. I just have a few more questions. I should commend the Senator from Massachusetts for his activity and leadership in this field.

Let me say very briefly, that increasingly I find in my work on the Commerce Committee representatives of private industry are coming forward to say that if we put up a commercial satellite, can we guarantee their safety, or will the International Telecommunications Union [ITU] mess up the developed countries' activities in satellite communications?

We are going to have Mrs. Kirkpatrick here to talk to us about some of the problems that the United Nations is causing in certain areas of our exports, including the export of telecommunications equipment. And, increasingly I hear the question: If we are going to match the French—they have a new satellite called Spot, which is an informational satellite—through private ownership in the United States can we provide security for our satellite if we are going to make that kind of an investment?

That probably is not your field necessarily. Our next witness may be able to answer it more appropriately. But do you see the importance of moving quickly in this area of arms control so we can clarify what is going to be deployed in space not just from a military point of view but from the commercial perspective? We are told that in a short time, it will be cheaper to go up to a satellite and down rather than having

a phone line between here and the Capitol. But if we become that dependent upon satellites for communications, then it becomes a national security issue.

I just have a feeling we are moving so slowly in this area, even if we get back to the bargaining table, as the Senator has pointed out, it looks like it would be years and years before we conclude an agreement. Is there really any hope of getting an arms control agreement in outer space?

Mr. ADELMAN. There is no question, Mr. Chairman, that this is an area of concern. There is no question that our goals are exactly the same. Could we eliminate the possibility of having antisatellite weapon capabilities in outer space? Should we do that? Yes; there is no question that we should do that. Should we make every effort to do that? Yes; there is no question we should make every effort to do that.

The question is, Can we do something about this that is in our national interest, that is verifiable, that will not lead to worse United States-Soviet relations in the future? That is the question and so there is no lack of commitment. There is no lack of seriousness on this issue. There might be a difference between you and me and Senator Tsongas on the approach you would take to get there.

I guess that Senator Tsongas would agree with me, and you would probably agree with me, Senator Pressler, that there is a difference in approach. I was saying there is a difference in approach that this administration has taken to arms control, and you can argue it both ways, but let me tell you a little of the difference in basic approach.

The difference in basic approach is that the President has decided in a pattern not to go into arms control directions that are not well thought out, that are not well staffed out, that the United States does not have a good, hard position on and a reasonable position.

He was I know, during the transition time, because I was familiar with the issues at that time—in the first few months of the administration, he was approached with the possibility of going to START [Strategic Arms Reduction Talks] and the INF talks and do it quickly to gain the upper hand, to send negotiators there to reopen those two arms control—this is the START and INF arenas—and to preempt any pressures that would come to him or to the administration for arms control later on.

The President took a position, right or wrong, but he took the position, let us not do that until we know exactly what we are going to propose, how it would affect our national security interest, how it would affect the future of arms control, and then, when we get that good position well thought out, we can have it as a block of concrete to stand on.

I know that you and Senator Tsongas are very anxious about going into bilateral negotiations with the Soviets, and that is a logically coherent position. You go into negotiations, see how they go, and then we can decide what position to take or how to solve these verification problems or how to target our treaty to solve future technology problems. That is a logical position to take, and I do not want to diminish it.

That is not my view and that is not the President's view, however, in that I believe it is more responsible and more serious for arms control

to have a well thought out position, to know exactly what you want out of those negotiations before you go into them.

Senator PRESSLER. The point is, I know it should be well thought out, but we are now 21½ years into this administration. It is 31½ years since the ASAT talks were suspended. The point I am making is that time is marching on. We have private companies that are hesitating to put up commercial satellites because they do not know what is going to become of them.

We have increasing militarization by both the Russians and ourselves. I have sponsored Senate Resolution 43 and I know that there are other similar resolutions, but it represents an effort to urge that we move much faster and give this a much higher priority. You have expressed that it will be a high priority, but are you going to fight within the administration to make this one of the highest priorities?

Mr. ADELMAN. Only if I find in ACDA that there is a very reasonable, good position for the United States to take in this area. Then I will fight like the dickens.

Senator PRESSLER. Well, what would that good, reasonable position be?

Mr. ADELMAN. That would be a position that would solve the major problems of the advancement of technology and of verification so that we have a good idea of what we would like to come out of these negotiations.

Senator PRESSLER. And if you do not find that?

Mr. ADELMAN. Then I cannot champion something I do not believe in.

Senator PRESSLER. Then we will not have talks. It will continue to be—

Mr. ADELMAN. If I do not think it would be in the U.S. interest to go into this field, and there would not be a possibility of an arms control agreement that would be equitable, that would be verifiable, that would not create future problems for future Presidents on the compliance situation, I could not recommend to the President to move ahead with them.

Senator PRESSLER. Obviously, if you concluded that it was not in the U.S. interest, you would not go forward, but I would say that based on everything I have seen that I hope this area does not fail for lack of U.S. participation. As I said in my New York Times article, the Soviet Union has been guilty of a lot of things, but in terms of this, let us not let this fail for lack of U.S. initiatives.

Mr. ADELMAN. I agree with that totally.

Senator PRESSLER. I get the feeling that it is being taken up very reluctantly and the general public is not very interested in this subject. If you went out on the street and started talking to people about it, people would not pay any attention. But within 5 or 10 years, it is going to be the key issue facing our society and then we are going to be into it so far it is going to hamper commercial development, which could provide major benefits for our society. Moreover, this space arms race is going to be extraordinarily expensive, to put it mildly.

Mr. ADELMAN. Let me just say, Mr. Chairman, if I could, that I agree with you entirely that this will not be an area that is not pursued because of lack of U.S. interest in the area and thorough work in the area.

I would think that in my time as ACDA Director that that is a very high priority of mine, to make sure that the negotiations we are involved in are very well staffed out and thought through and solid, and that other fields, like the ASAT field, that we tried our best and that we did it seriously, and we did it not reluctantly but with enthusiasm and with drive.

And if we cannot find a technique to answer these, what Gene Rostow called the daunting problems, we just say we tried our best and we have no reluctance about the results and we are very proud of the effort we expended on it. But, honest to goodness, we tell you that we cannot solve these problems. And that is legitimate, but it is not going to be decided like that, on the basis of laziness or negligence at all.

I agree with you entirely on that.

Senator PRESSLER. I hope we are not sitting here 10 years from now spending over \$100 billion or \$150 billion a year on space weapons for lack of initiative at this time. You are really in a key position to take some of those initiatives within the administration.

Senator TSONGAS.

Senator TSONGAS. Let me raise two political-philosophical questions and two technical matters, but before I do, Dave Emery said yesterday that he was in favor of ratifying the two other treaties and then going on with the question of verification, so I take it you and he disagree.

Mr. ADELMAN. Basically he was expressing the opinion that the verification provisions could be addressed at a future time. I think it was a question of timing rather than a question of disagreement on this, because his position, as I understand it, is that the verification arrangements have to be addressed. You are talking about during what stage?

Senator TSONGAS. He said ratification first and then deal with the verification issues.

Mr. ADELMAN. I believe that is true.

Senator TSONGAS. That is not your position?

Mr. ADELMAN. That is not my position.

Senator TSONGAS. Would you rather deal with the political issues first or the technical issues?

Mr. ADELMAN. I was an undergraduate in philosophy, so I love to talk about philosophy.

Senator TSONGAS. OK. Let me ask you a philosophical question, then. Is the Soviet Union the focus of evil?

Mr. ADELMAN. I think the Soviet pattern of behavior through the years is one that is adverse to many of our fundamental interests.

Senator TSONGAS. Evil?

Mr. ADELMAN. Our pride, the real hallmarks of our civilization, our freedom, are for nonaggression, are for liberty, and the Soviet Union is not practicing those traits at all.

Senator TSONGAS. Are they evil?

Mr. ADELMAN. I believe that the Soviet pattern has been very, very disruptive. Evil is a word that has a religious connotation to it.

Senator TSONGAS. Evangelical, even.

Mr. ADELMAN. Evil has a religious connotation to it. I believe they are harmful to the human spirit. The Soviet Union's pattern of behavior is such as to repress what I think are the greatest parts of individual human beings—their freedom, their artistic skills, their energy, their imagination.

Senator TSONGAS. So you do not have any disagreement with the President's characterization of them as evil?

Mr. ADELMAN. No. That is not to say, Senator Tsongas, that there would not be areas that we could work out agreements. We talked about the grain situation. We talk about arms control. I did a lot of negotiating with the Soviets on resolutions in the United Nations.

OK. I know where they are coming from; they know where I am coming from. And that does not mean that we cannot have good personal relationships or productive relationships in the area. That means that their direction, the fundamental basis of their society is, I think, at odds with the fundamental values, principles of our society, and so that is why I have a little trouble with the word "evil."

In a religious setting, evil would be in such a manner as to exclude any dealings with them, but I would not put that spin on it myself.

Senator TSONGAS. You and I have discussed the issue of the hearts and minds battle in Europe, whether the Europeans view the United States or the Soviets as the obstacles to arms control. Do you believe that we are winning or losing that particular confrontation?

Mr. ADELMAN. I believe that we can do a lot better, and I have admitted that to you that it has been an area of concern. As I told you in your office, before entering the Government in April 1981 I wrote an article in *Foreign Affairs* about public diplomacy called *Speaking of America: Public Diplomacy in my Time*, and the point of the article was exactly the kind of thing that you have been involved in, not only urging that we do more in the European front but also on the kind of exchange programs that you have recommended and which I think basically are very good programs between the United States and the Soviet Union.

So I am in the camp very much—I hate to embarrass you by saying this—in the Tsongas camp—saying that on the public diplomacy front we should be a lot more vigorous and do a lot more. I was disappointed when, I believe it was this committee, slashed quite a bit of funds from Project Democracy. That is not in my bailiwick, but being my hobby and being a passionate interest of mine—the hearts and minds of Europeans—for years, I think taking money out of that is pennywise and pound-foolish.

Senator TSONGAS. How do you think the Europeans reacted to both the "Focus of Evil" speech and the "Star Wars" speech?

Mr. ADELMAN. On the two speeches, I think the Europeans generally feel that those speeches were too direct and too ascerbic. I think that would be a fair characterization. But that is true of a lot of statements, Senator Tsongas.

I think that during the time of Afghanistan the Europeans felt that way about President Carter, and I remember reading many times that they thought he was overdoing it on Afghanistan and his statement was too harsh and his rhetoric was too severe and that the Americans should tone down. They always had that problem with Brzezinski and other elements of the Carter administration.

I think there is generally a tendency—a tendency I understand but do not share—of toning down that kind of approach.

Senator TSONGAS. You think it is angst?

Mr. ADELMAN. In what sense?

Senator TSONGAS. I think Richard Perle is the one that said that all this arms control nonsense to come out of Europe was a result of partisan angst.

Mr. ADELMAN. You are asking me to answer for his comments? Why don't you just address them directly?

Senator TSONGAS. I have.

Mr. ADELMAN. What is the answer?

Senator TSONGAS. Somewhat like yours, but I am not quite sure when it is over exactly what I got from it. [Laughter.]

Mr. ADELMAN. I thought it was very clear, and let us go through it. You said to me are the Europeans, would they think that those kinds—

Senator TSONGAS. I was not referring to that response. I was referring to the first question I asked you about comparing the verification difficulties of the various—

Mr. ADELMAN. OK. Let us review that one just so we get it straight right before I leave the table. You are asking me to compare treaties that are being respected to treaties that are not ratified, to treaties that are not written. How can you compare something like that?

If I say to you is your resolution on the outer space arms race better than a resolution that Senator Mathias is thinking of doing, or that Senator Boschwitz has on the back of an envelope, you would say I do not know. I have not seen it yet. That is a legitimate answer to that.

Senator TSONGAS. I would say based on our previous experiences that mine probably would.

Mr. ADELMAN. Yours would be better? [Laughter.]

But the fact is we are working on INF and START right now.

Senator TSONGAS. I just meant that humorously, not to reflect on individuals.

Mr. ADELMAN. I took the committee, as I always do, very seriously.

Senator TSONGAS. The two technical questions are: One, do you think that on the issue of verification that the Soviet ASAT system of sending up a satellite with an SS-9, et cetera, is more or less difficult to verify than our F-15 ASAT system?

Mr. ADELMAN. That is something I would just have to look at while one of the studies—after the results of the technical studies that are outstanding right now. We have that very question being tasked out in one of our research endeavors now, to look at those kind of considerations.

My simple answer would be to you that both are very tough.

Senator TSONGAS. Well, there is our system—a little thing under a plane—and theirs is a rocket which has apparently a distinct configuration. You have no instinct as to which is more?

Mr. ADELMAN. The booster they currently use is not the only launch vehicle for the system, you would have to look at other launch vehicles as well.

Senator TSONGAS. So it would be one of their existing ICBM systems?

Mr. ADELMAN. It could be that or other techniques as well. It does not have to even be an ICBM system.

If I could, Senator Tsongas, say that verification is not only what is visible, but it gets into the area of cooperative measures, of notification, of inspection, of revealing—you could have entry and exit points. You could have a system whereby all ASAT weapon systems—I am just talking theoretically—would be in a certain area, and there would be a fixed point for entry and exit so you would know how many systems there were.

If a system goes out of the environment, so to speak, you would know about that and you would be able to tell those systems very well. So do not think to yourself that you would have to look at each system that you see. You could, with willingness on both sides, you can solve verification. That is the simplest answer you can give—that if both sides want to open up their systems to a particular measure, because both sides are very intent on an agreement, you can solve verification.

The degree of intention and the degree of commitment to solving the problem is different.

Senator TSONGAS. See, that is part of the reason that those two other treaties are important, because they have accepted on-site inspection.

Mr. ADELMAN. Only PNE.

Senator TSONGAS. That is right. But here is a major step in the right direction.

Mr. ADELMAN. I think that is a valuable part of that.

Senator TSONGAS. DeLauer said in yesterday's Times that with unconstrained proliferation no defensive system will work. Do you agree with that?

Mr. ADELMAN. I believe right now there are technical problems to a wholesale defensive system. I thought the rhetoric against the President's speech was far worse than the rhetoric that the President has given at any time. It seemed to me that a consideration of defensive systems so that you could stop the offensive buildup on both sides in coming years is a very desirable goal.

You can say it is technologically not possible any time in the near future, and the President has admitted that in a speech—technologically not possible any time in the near future. He is talking about a goal that is out years away but still is something we should keep in mind and try to pursue.

We should try to pursue it not because of complete coverage from the Soviet Union, that we are going to stop all incoming ICBMs or going to have this barrier up there, but I can see a use through the years, in the coming years, to stop a country that, God forbid, would get a nuclear capability because of the nonproliferation efforts not proving as great as we would like, that would be in a position of creating problems for the United States with a very few nuclear weapons.

Some kind of approach to address that problem, I think, would be valuable. That is a long way in the future. It may not be technologically possible now, but you should not dismiss it as a desirable goal.

Senator TSONGAS. That sounds like "High Frontier" talk.

Mr. ADELMAN. That is the kind of talk that you have been giving in the sense of technological advancement and high technology turnover, and the kind that Senator Pressler has been talking about. I do not think there is any argument that that is not possible today.

I do not know of anybody, including yourself, Senator Tsongas, or Senator Pressler, who would not say no, it is just not going to ever be possible in this century. No one could say a statement like that.

Senator TSONGAS. I would hate to see this administration go down as the only one since Kennedy's time that did not conclude or make a step forward in the arms control area.

Mr. ADELMAN. I agree with you entirely, and if I have anything as Director of ACDA that I am going to be dedicated toward, it is to moving the process of arms control negotiations as far as I possible can that are in our interests.

Senator TSONGAS. Will the chairman indulge me one quick question?

Senator PRESSLER. Go ahead.

Senator TSONGAS. Of those six initiatives we spoke about, which do you have the greatest hope can be resolved in the first term of President Reagan?

Mr. ADELMAN. I think the INF holds out the best hope right now.

Senator TSONGAS. Just for the record, the "first term" does not assume "second term."

Mr. ADELMAN. I think the last time we talked together we were talking about second terms of Presidents and you were up there reading not from Aviation Week but from something about second terms in the Wall Street Journal.

Senator TSONGAS. You made some statements about what happens to people in their second terms.

Mr. ADELMAN. I wrote a longer article on that—it was in the New York Times at one point—called "Second Terms to Worry About."

Senator TSONGAS. I will dig it out.

Mr. ADELMAN. Please do not. [Laughter.]

Senator PRESSLER. Let me thank you for being here. I have some additional written questions for you on what the effect of ASAT will have on NATO communications and what could happen by Soviet killer satellites in the event of a war in Europe.

Also, let me say that I hope we see a major arms control agreement during the President's first term and more during his second term, from my point of view.

Mr. ADELMAN. There is a little partisan note for you, Senator Tsongas.

Senator TSONGAS. I would submit that if there is not one in the first term, that may well result in there not being a second term. That is an objective, nonpartisan view. [Laughter.]

Mr. ADELMAN. Bipartisanship is the word of the day.

Senator PRESSLER. We thank you very much. We look forward to working with you.

We are running short on time so we will ask Mr. Ikle to come forward and to give his testimony. Thank you very much.

Mr. ADELMAN. Thank you very much, Mr. Chairman.

Senator PRESSLER. Mr. Ikle, thank you very much for being here and I apologize for mispronouncing your name earlier. I have had breakfast with you and I know you and my staff handed me a note with great alarm. We appreciate your being here.

If you would summarize your testimony, I understand that a press conference is occurring at 12:30 that many people wish to participate in, so we are going to have to move along, but by no means minimize. If you can summarize and put your statement in the record, we will go into questions, but take as much time as you need.

**STATEMENT OF HON. FRED C. IKLE, UNDER SECRETARY FOR POLICY,
DEPARTMENT OF DEFENSE**

Dr. IKLE. Mr. Chairman, in fact I was going to propose that I be very brief in my opening testimony to give you time for your questions.

I obviously welcome this opportunity to discuss with you the national security implications of outer space and the President's recent initiative on ballistic missile defense. The technological evolutions and the possible uses of outer space have opened up new opportunities as well as new threats to our national security.

Both U.S. Armed Forces and Soviet Armed Forces use space systems to a great degree. They are used increasingly for command, control, and communications. Our launch detection satellites and strategic warning systems contribute to our nuclear deterrence, and space systems enable us to monitor compliance with arms control agreements.

Needless to say, our U.S. military use of space is consistent with international law. Our military space programs are not simply a reaction to Soviet space activities but are the result of our continuing evaluation of the best means for achieving our national security objectives.

In the past 10 years, the U.S.S.R. has been launching more than 75 spacecraft per year, a rate 4 to 5 times that of the United States. Over the past few years, the rate has been close to 100 annually. The annual payload, weight, placed into orbit by the Soviets is even more impressive—600,000 pounds, 10 times that of the United States.

This level of effort reflects the importance the Soviet military attaches to their space programs. It may also reflect some technological weaknesses in the longevity and flexibility of their spacecraft, to be sure. Soviet military space programs range all the way from manned missions to meteorological, communications, navigational satellites, and so forth.

I shall skip essentially most of the summary of the description of the Soviet spacecraft program, since it will be in my opening statement submitted for the record, Mr. Chairman.

The Soviet commitment to their manned space program is also growing. The development of a large manned space station by about 1990 seems a possibility to maintain a military presence in space, and this may be one of the goals of the heavy life launcher systems that we now see in development.

The Soviets may also use the heavy lift space boosters to orbit even larger space stations and space modules before the end of the century. Such stations could weigh more than 100 tons and would be able to support a large crew for extensive periods without replenishment.

The Soviets, as you discussed during Mr. Adelman's testimony, have an operational Soviet antisatellite system which has a capability to destroy U.S. systems that are in near-Earth orbit. They conduct yearly tests to practice satellite interception and to refine their antisatellite capability. We think that one of the purposes of the Soviet Union's space program is to develop a space-based laser that could be used for antisatellite attacks.

Let me just add a few words to conclude and give you time for your questions on our own activities and then on the President's program for strategic defenses.

Given the antisatellite capability that the Soviets have been developing and testing for some time, we have to pay a great deal of attention to survivability and endurance of our satellites, and that is technologically a very difficult problem. The treaties, of course, that govern our current activities, as I mentioned before, our activities are fully consistent with these treaties and the treaties to restrict and prohibit certain operations in outer space.

In conclusion, a few words about the President's initiative on strategic defense. The President decided that we embark on a program to counter the Soviet missile threat with measures that are defensive. As you know, he directed a comprehensive, intensive effort to define a long-term research and development program toward the goal of eliminating the threat posed by nuclear missiles. This development could be, indeed should be, complemented by arms control measures.

Now in accordance with the President's decision, the Defense Department, in cooperation with the other agencies, has initiated a two-pronged effort—one, to explore and prioritize the technological possibilities, and the other to develop and define the policy and strategy options.

We are not envisaging a single system to intercept or defend against all missile attacks. Our research is designed to explore a defense network, a series of systems not necessarily based on the same technology and same physical principles, systems which, taken together, will provide an effective defense against nuclear ballistic missiles for us and for our allies.

We recognize, of course, that this is a long-term effort. Because it is a long-term effort, we need to be clear, as the President explained, that we must continue for the interim to rely on the deterrent threat of retaliation to preserve the peace, and we must and will continue to pursue the agreed reductions in nuclear arms that are balanced and verifiable.

Since the search for defensive technologies has the goal to reduce the threat of ballistic missiles, it is fully consistent, indeed it dovetails, the arms reduction effort that we are pursuing today in the START negotiations. It supports those efforts by offering the prospect that the effectiveness and role of ballistic missiles may be reduced sharply in the future.

The President's initiative, of course, is also fully consistent with existing arms control agreements, including the ABM Treaty, which permits research.

Mr. Chairman, the essence of the President's decision on strategic defense, in my view, is that it opens up alternative avenues to preserve the peace in the nuclear age. President Reagan's successors in the next decade or in the first decade of the next century should not have their options limited by the strategic notions that were fashionable in the 1970's.

Our strategic planning has been restricted far too much by the idea that defensive systems are bad and that we can and must indefinitely remain locked into confrontation of all-powerful offensive missile forces. We owe it to the next generation, I believe, to make a determined search for better alternatives.

I am pleased to answer your questions, Mr. Chairman.

[Secretary Ikle's prepared statement follows:]

PREPARED STATEMENT OF HON. FRED C. IKLE

Mr. Chairman, I welcome this opportunity to discuss the national security implications of outer space and the President's recent initiative on ballistic missile defense.

The technological revolutions in the possible uses of outer space have opened new opportunities—as well as threats—for national defense. Both United States and Soviet Armed Forces use satellite systems. U.S. military space assets provide support for military operations, such as: communications, command and control, warning, navigation, and weather information. In fact, space systems are used increasingly for command, control and communications. Our launch detection satellites and strategic warning systems contribute to our nuclear deterrence. Space systems also enable us to monitor compliance with arms control agreements.

Needless to stress, the U.S. military use of space is consistent with international law.

Our military space programs are not simply a reaction to Soviet space activities but are the result of our continuing evaluation of the best means of achieving our national security objectives. We see space as a region in which supporting military operations may be carried out. While our programs are not a reaction to those of the U.S.S.R., we must, of course, take account of Soviet space activities. As in other areas, the Soviet approach to space differs considerably from our own.

SOVIET SPACE ACTIVITIES

With the development and employment of an orbital antisatellite weapon over a decade ago, the Soviet Union clearly signaled its recognition of space as an arena in which to conduct war.

In the past 10 years, the U.S.S.R. has been launching more than 75 spacecraft per year, a rate of four-to-five times that of the United States. Over the past few years, the rate has been close to 100 annually. The annual payload weight placed into orbit by the Soviets is even more impressive—660,000 pounds—ten times that of the United States. This level of effort reflects the importance the Soviets attach to their space programs. But it may also reflect some technological weakness in the longevity and flexibility of their spacecraft. Soviet military and military-related space programs range from extended manned missions, to meteorological, communications, navigational, reconnaissance, surveillance, targeting and antisatellite missions.

Since the U.S.S.R.'s successful launch of Sputnik I in 1957, the Soviets have pursued a vigorous and methodical program to exploit space for military purposes. The initial Soviet use of space for military applications occurred in 1961 with the launch of their first photographic reconnaissance satellite. Throughout the 1960's and 1970's, Soviet military space programs expanded in both scope and numbers. By now, these programs had developed into mature, integrated systems for the direct and indirect support of Soviet military forces, and with the capability to threaten low-altitude U.S. and allied satellites.

On any given day, 70-110 Soviet satellites are in orbit, more than half of which serve primarily military purposes. Some 85 percent of all Soviet space launches are primarily military or joint military/civilian missions.

It appears that the Soviets are developing a re-usable space system, similar to the U.S. space shuttle, and a smaller space plane. Orbital developmental test flights of the smaller vehicle have already occurred. These systems could be in regular use within a decade and will further expand the military flexibility and capability of the Soviet space effort.

Soviet manned space missions are becoming increasingly complex and constitute the single most extensive element of the Soviet space program. After accomplishing many firsts in the early 1960's, including the first man in space, the Soviet manned program was momentarily overshadowed by the U.S. manned program during the late 1960's. Since 1971, the Soviets have placed seven space stations in orbit. The first Salyut I manned space station was launched in 1971. A second type of Salyut station was launched in 1973. Both were capable of conducting military research.

By 1977, the Soviets had developed the capability to resupply and exchange personnel on their Salyut space stations. On three occasions the Soviets have conducted manned missions lasting as long as 6 months. With completion in 1982 of the 211 day mission, the Soviets set a new record.

The Soviet commitment to their manned space program is growing. The development of a large manned space station by about 1990 to maintain a military presence in space is, we believe, one of the goals of the new heavy-lift launcher systems now in development. The Soviets also will use the heavy-lift space boosters to orbit even larger space stations and space modules before the end of the century. Such space stations could weigh more than 100 tons and be able to support a large crew for extended periods without replenishment.

The U.S.S.R.'s introduction, application and known future development of space weapon systems point to a coordinated program involving:

The present generation of antisatellite vehicles, now operational and designed to destroy low-orbiting satellites.

A very large, directed energy research program including the development of laser-beam weapons systems which could be based either on the ground, or aboard the next generation of Soviet antisatellite systems or Soviet manned space stations.

The operational Soviet antisatellite system has the capability to destroy U.S. space systems in near-Earth orbit. The Soviets conduct yearly tests to practice satellite interception and to refine the ASAT system. We believe that one of the purposes of the Soviet Union's space weapons program is the development and deployment of a space-based laser. The Soviets could launch the first prototype of a small space-based laser antisatellite weapon in the late 1980's or early 1990's. A system capable of attacking other satellites within a few thousand kilometers range might be possible in the 1990's. Space-based ABM systems could be tested in the 1990's, but probably would not be operational until after the turn of the century.

The Soviets have steadily increased their space photographic and electronic reconnaissance effort since the early 1960's. Each year over 50 of these satellites are launched to support military forces on a daily basis. The Soviet military space program also reflects an ever-increasing use of space for world-wide surveillance and warning. The Soviets have brought a number of United States and allied military forces under surveillance by these space-based systems. The surveillance satellites include an ICBM launch detection system and ocean surveillance systems, such as the two nuclear-powered satellites that caused worldwide alerts during their breakup and reentry into the Earth's atmosphere in 1978 and early 1983. Soviet efforts in the surveillance field are expected to lead to a multi-satellite detection, surveillance and attack-warning system against strategic and non-strategic ballistic missiles and possibly bombers as well.

The Soviets also are increasing their use of space systems for command, control, and communications. Since the mid-1960's when their first communications satellite was launched, the U.S.S.R. has continued to improve and expand its communications satellite programs to support its political leadership and its military, diplomatic and intelligence missions.

The Soviets have embarked on an ambitious expansion of their communication satellite program that will significantly enhance their global command, control and communications capability. Over the next 10 years, the Soviets will develop and deploy an even more advanced series of communication satellites, some of which might relay transmissions from manned orbital command and control platforms.

DOD SPACE ACTIVITIES

Let me now turn to our own activities. In support of our national security, the Department of Defense acquires and operates space systems and pursues space-related research and technology development projects.

As noted, Soviet development of an operational antisatellite capability presents the potential for space to become a hostile environment. Therefore, the DOD space policy directs that military space systems, including essential ground elements as well as orbiting spacecraft, be designed, developed and operated to enhance their survivability and endurance.

Since 1977, it has been U.S. policy to pursue the continued development of an operational, non-nuclear antisatellite capability. If we have a credible retaliatory capability, we are better able to deter attacks against our space systems.

We are currently signatories of at least three treaties—which affect certain military activities in space: the Outer Space Treaty, the Limited Test Ban Treaty, and the Antiballistic Missile Treaty, our treaty obligations include:

Liability for damages from activities in space (Outer Space Treaty);

The maintenance of space access to and operations in space (Outer Space Treaty);

And noninterference with national technical means of verification (ABM Treaty, Salt I, Salt II).

The Outer Space Treaty also prohibits, on the Moon and other celestial bodies, the establishment of military bases, installations, and fortifications, the testing of any types of weapons, and the conduct of military maneuvers. This treaty also prohibits the placement in orbit around the Earth, installation on the Moon or other celestial bodies, or stationing in outer space of any objects carrying nuclear weapons or any other "weapons of mass destruction." The testing or orbiting (in outer space proper) of weapons using conventional explosives is not prohibited.

The 1972 ABM Treaty prohibits the development, testing, and deployment of space-based ABM systems and components (article V). Should future technology bring forth new ABM systems "based on other physical principles" such as lasers and particle beams, as opposed to those employed in current systems, it was agreed that limiting such systems would be discussed before deployment in accordance with the treaty's provisions for amendment.

In conclusion, let me say a few words about the President's initiative on strategic defense. The President decided that we embark on a program to counter the Soviet missile threat with measures that are defensive. He directed a comprehensive and intensive effort to define a long-term research and development program toward the goal of eliminating the threat posed by nuclear missiles. This development could be—indeed should be—complemented by arms control measures.

In accordance with the President's decision, the Defense Department, in cooperation with other agencies, has initiated a two-pronged effort: one to explore and prioritize the technologies, and the other to develop and define the policy and strategy options. We are not envisioning a single system to intercept and defend against all missile attacks. Our research is designed to explore a defense network—a series of systems not necessarily based on the same technology or physical principles—which taken together will provide an effective defense against nuclear ballistic missiles for us and our allies. We recognize full well that this is a long-term effort whose fruits may not be available until the next century.

Because this is a long-term effort we need to be clear, as the President explained, that we must continue for the interim to rely on deterrence to preserve the peace. We also must—and will—continue to pursue agreed reductions in nuclear arms that are balanced, and verifiable. Because our search for defensive technologies has the goal to reduce the threat of ballistic missiles, it is fully consistent with the arms reduction effort we are pursuing today in the START negotiations. It supports those efforts by offering the prospect that the effectiveness and role of ballistic missiles may be reduced sharply in the future. The President's initiative is, of course, also fully consistent with existing arms control agreements. While the ABM Treaty does prohibit the development, testing or deployment of ABM systems, it does permit research.

Mr. Chairman, the essence of the President's decision on strategic defense, in my view, is that it opens up alternative avenues to preserve the peace in the nuclear age. President Reagan's successors—in the next decade, or in the first decade of the next century—need not have their options limited by the strategic notions that were fashionable in the 1970's. Our strategic planning has been restricted far too much by the idea that defensive systems are bad and that we can and must, indefinitely, remain locked into a confrontation of all-powerful, offensive missile forces. We owe it to the next generation to make a determined search for better alternatives.

Senator PRESSLER. Thank you. You are the first witness, I believe, who has appeared since the President's speech who can give us some detail of the laser defense proposal. There seems to be some difference in what the White House says and what the Pentagon says. I know that the White House Science Adviser has enthusiastically urged that we move quickly toward laser BMD systems, but Dr. Cooper of DOD seems to feel that we have to make major breakthroughs in technology before we can deploy space-based BMD systems.

What is your feeling?

Dr. IKLE. These two things are not inconsistent. You can push forward to make the breakthrough. This is what is reflected in the White House background, I think. I was in that background myself that you are referring to. And at the same time you are being realistic and want to recognize the technological hurdles that have to be overcome, the kind of which have often been overcome in our research and development efforts, in civilian as well as in military objectives.

Senator PRESSLER. Is it the Pentagon's position that lasers could make us safe from incoming ICBMs?

Dr. IKLE. The position, as I stated in the opening statement, is that we are looking not toward a single system based on a single principle, but to a combination and network of systems that in turn we envision would be complemented by arms-control limitations.

It is down that road that you could get the reduction and elimination, eventually, of the ballistic missile threat.

Senator PRESSLER. Now assuming the worst for a moment—though we should always hope for the best—but let us assume we do not get arms control agreements or limitations. You say "systems," by which perhaps you mean the laser system, ASATs, combined maybe with a platform in outer space, which could attack nuclear missiles. I suppose it is the whole group.

How much is that going to cost, in your estimation, assuming the worse?

Dr. IKLE. It would be premature to cost something that has not been fully defined and described. You can only guess the cost now of various elements.

Let me support the thrust of your question by stressing that one of the most important aspects of any such defensive systems is the ratio between the cost of the defensive system and the cost that your adversary would be incurring for overcoming it. If that cost ratio is favorable to the defensive system, then indeed you can move forward and reduce the offensive threat, and then probably arms control agreements might more easily follow.

If it is the reverse, if we assume it is so much easier and cheaper to overcome the defense with new countermeasures on the offensive side, then the prospects are not good.

Senator PRESSLER. We are having increasing questions, as I said earlier, in the Commerce Committee from private groups who are interested in getting involved in outer space things for the betterment of mankind. But there is also a fear that it is going to be such a militarized outer space, with ASATs, and lasers, and killer satellites, and so forth, and platforms to attack nuclear weapons, that they are not willing to make a long-term investment and indeed mankind is suffering to some extent, economically and otherwise, by a holdup.

How close are we or how real is this space wars thing? Are we just talking about something that is imaginary or how close are we to it?

Dr. IKLE. I was seriously puzzled when you raised this question earlier what those people had in mind that have come to you and said they were concerned.

Senator PRESSLER. You were puzzled?

Dr. IKLE. Yes. Could you explain?

Senator PRESSLER. I would be glad to. For example, if you are going to put up a weather satellite at great investment, or if RCA is going

to put up an informational satellite, or if someone is going to put up some kind of a commercial satellite to transmit information, they want to know that it will be safe from attack, if there is a killer satellite that might take it over at some point, if there is going to be warfare of some sort, if it is vulnerable. Can we protect it?

It is like someone putting a ship to sea. The question is, is it vulnerable to foreign destruction or interference at certain times. I understand that we would communicate with NATO via satellites in time of war. Would that be vulnerable?

Dr. IKLE. I thought that is what these executives had in mind, but I could not quite believe it. It really shows a total lack of a sense of proportion on their part that they should worry about putting a fraction of their corporate assets into space because in time of war those might be vulnerable, while all their other assets, as you mentioned—ships on the ocean, all their buildings on the ground, their people, their own families—would also be vulnerable in time of war.

Senator PRESSLER. But is it not true that DOD has asked commercial satellite makers to harden their systems because of the threat?

Dr. IKLE. Well, much as we may ask ground-based communications system that we would use for military purposes to be hardened.

Senator PRESSLER. This is for commercial satellites, and hardening is very expensive. But DOD has already asked commercial satellite makers to harden their systems. There must be a reason for that. Your Department—you see, you are puzzled as to why there would be concern—has asked commercial satellite makers to harden their systems. What is the threat to them, then?

Dr. IKLE. We are very concerned about the vulnerability of all command, control and communications systems and the Department of Defense and the military services use commercial communications systems to a great extent or are integrated with commercial communications systems.

Senator PRESSLER. Military communications pass through both.

Dr. IKLE. They pass through or provide alternatives, so if you start worrying about protecting communication systems against conventional or nuclear attack, you look at these alternatives—commercial systems—that could serve as backups or that may be used in normal times.

Senator PRESSLER. But why were you puzzled by the fact that people should be concerned? What they are asking is what is going to happen in this war in outer space? There is a lot of things not occurring in terms of commercial development that could be happening anticipating this threat in outer space.

Dr. IKLE. If their concern is that there is some casual war in outer space without further consequences that an aggressor might engage in, playing around and pulling back again, then I perhaps could see that they feel that these expensive systems up there might be far more vulnerable than all their other assets.

But that, of course, is not the case. An aggressive action in outer space against satellites, in most instances, would, first of all, be a violation of existing agreements and would be an act of war. Once you reach that situation, if I were a corporate executive or just an ordinary common citizen, I would be far more worried about the vulnerability of the assets in space that we live in.

Senator PRESSLER. The UPI recently did a report on the fiscal year 1984-88 defense guidance and excerpted the following quotation from this document:

We must ensure that treaties and agreements do not foreclose opportunities to develop these capabilities and systems contributing to strategic stability and deterrence. In particular, it must be recognized that agreements cannot protect our defense interest in space during periods of hostilities.

These capabilities in question are antisatellite weapons. Is this quote accurate? Does the Pentagon, in fact, oppose agreements that would seek to ban or place limits on ASAT weapons?

Dr. IKLE. The quote seems to be accurate. I would have to check it. But the sense of the quote I have no problems with. Properly worked out agreements against antisatellite weapons we do not oppose. The statement there that you read says that agreements that would undermine stability or deterrents which we rely on to preserve the peace would be undesirable and that we must recognize that in time of war these agreements would not provide protection. I could not quarrel with that.

Senator PRESSLER. Has DOD opposed efforts by other departments to resume ASAT negotiations in your interdepartmental discussions? Has DOD opposed efforts by other departments to resume ASAT negotiations?

Dr. IKLE. I do not recall that we had much differences there between the departments in discussing the approach to the handling of the negotiations in Geneva, which I think were described by Director Adelman.

Senator PRESSLER. At this time I will call on Senator Pell. May I say that Senator Pell has done an excellent job of raising this issue. There are very few people or Senators who have been as interested in this area, and we appreciate your leadership.

Senator PELL. Thank you very much, Mr. Chairman. Without you being chairman of the Subcommittee on Arms Control, we would not be having this hearing and we would not be taking all the action that we are.

Dr. Ikle, welcome. In April, Mr. Jan Lodol, the former NSC staff member, told us:

If we reduce the world's nuclear arsenal by a factor of 100 we would still have a nuclear arsenal left on both sides which could destroy all the major cities in the Soviet Union and the United States.

If this is correct, I do not see any way we can build defensive systems. Would you agree with the assessment of the destructive potential of nuclear weapons—that we could reduce the number of nuclear weapons to one-one hundredths of what we have now and still be able to destroy all the major cities in both nations?

Dr. IKLE. Well, if it was the purpose of those who control those nuclear weapons just to cause wanton destruction with no national objectives in mind, then indeed even one-one hundredths of the arsenals could destroy a great many cities and kill millions of people.

That is one of the problems in the nuclear age. If you have a completely irrational use of nuclear weapons or, for that matter, nuclear radiological material in reactors or what have you, you could cause a great deal of havoc.

The statement you refer to I think makes a point that is important in connection with the President's initiative on strategic defenses. It is precisely if you look forward to an indefinite future where all the emphasis is on offensive forces, then even under the best possible arms control reduction arrangements where you reduce these offensive forces, say by a factor of 100 or down to the level where they can be hidden and you could never find them, you would still have a serious threat of this kind if you are without defenses.

And that, I think, is one of the interesting possibilities of an era where the defensive forces would be more dominant, that you could cope more effectively with hidden offensive weapons.

Senator PELL. Thank you.

Now, getting to the nub of the matter, though, would you agree that achievement of an airtight defensive system would be very unlikely?

Dr. IKLE. It is very difficult to defend against all forms of delivery of nuclear arms. The initial focus of our effort is on ballistic missiles. Why? Because these ballistic missiles, with their short flight time, are particularly destabilizing. They do not permit responses that could alert the forces without creating great risks.

Senator PELL. On a different subject, you may be familiar with the resolution that Senator Matsunaga and I are cosponsoring, Senate Concurrent Resolution 16, expressing the sense of the Congress that the President should initiate talks with the Soviet Union and other Governments to explore opportunities for cooperative East-West ventures in space. What is your reaction to our resolution?

Dr. IKLE. We, of course, have had certain cooperative ventures. One problem that they create is the risk of the transfer of militarily relevant technology. As you get into these ventures, you want to guard against that. You become somewhat inhibited. It is a delicate project. That is not to say it is totally excluded from being pursued.

To engage with your principal military adversary in a cooperative venture in an area where the technology is so advanced and you are so concerned about guarding against undesirable technology transfer.

Senator PELL. But with the proper safeguards, would you favor such exchanges? With safeguards?

Dr. IKLE. We have had exchanges and cooperative ventures in the space area. If I were to structure the priorities of areas where we would cooperate, I do not think I would put space on top. I think I would pick other areas—health, agriculture, and so on.

Senator PELL. But the danger is not going to come from agricultural methods.

Dr. IKLE. Oh, indeed, but precisely because it is a dangerous area it may not be the ideal area for cooperation. It is more an area where you want to limit the danger through agreements first.

Senator PELL. I do not believe the executive branch has sent us up yet a reaction to this resolution. Would you do so?

Dr. IKLE. I will check into the status of the response to it.

[The following information was subsequently received for the record:]

Senator, the Administration is currently in the process of developing a formal response to S. Con. Res. 16. The Department of State will act as the Administration spokesman on this matter. Department of Defense views will, of course, be included in the Administration response.

Senator PELL. On another subject, the panel of specialists that will follow you—and I will curtail by questioning after this because we want to get to them—have drafted a report which takes the view that the Soviet ASAT poses a limited threat not requiring the testing and deployment of our F-15 ASAT.

What would be your response to this assessment?

Dr. IKLE. The evaluation of possible limitations on antisatellite that are verifiable has to consider a range of contingencies. First of all, a number of ASAT technologies can be based on the ground in the future, so we have to explore that.

Second, you really have to consider that since we do not expect, unlike maybe those corporate executives who are worried, we do not expect antisatellite warfare to be started casually in peacetime. What we really have to worry about is how the agreement would work out in wartime—to what extent the Soviets might, by preparing things without much testing, suddenly break out and have an overwhelming capability to deny us command, control and communications systems, say, in a conventional war, while their systems would be invulnerable because we have stopped our development.

Senator PELL. I think the press have indicated that our F-15 system is soon to be tested. Can you comment on those reports?

Dr. IKLE. I could not give you a forecast on the test date. I believe that is classified. I might be able to furnish you something on the record.

Senator PELL. Could you furnish us something on the record in writing and classified?

[The information referred to is classified and is retained in committee files.]

Dr. IKLE. I will check into that, certainly.

Senator PELL. Thank you very much. In view of the necessity of getting further witnesses up, I will desist.

Senator PRESSLER. We will be receiving that and we will notify the members of the committee when that report comes.

Senator Tsongas.

Senator TSONGAS. Good morning. If I could ask you two questions which I asked of Ambassador Adelman, one, according to Aviation Week the ASAT carried by the F-15 is going to begin testing this summer, in October the second testing, and in early 1984 testing against actual simulated targets.

Is that the case?

Dr. IKLE. This gets back to Senator Pell's question, and we want to supply something for the record on a classified basis.

Senator TSONGAS. Well, let me leave that, then.

Senator PELL. Would you say that those estimates are inaccurate? Could you say that?

Dr. IKLE. Well, I think as long as you are talking about a schedule of testing that is classified I do not think it would be purposeful if I commented on it in public.

Senator TSONGAS. Did anybody tell Aviation Week that?

Dr. IKLE. Aviation Week is full of data and we cannot always verify those in public in particular. Some are wrong, and some may be right.

Senator TSONGAS. But you will verify it in private. Is that correct?

Dr. IKLE. We will give you the answer on the testing that we can separately.

Senator TSONGAS. Do you feel that the Soviet ASAT system that they have now, that they now are testing, is easier to verify or more difficult to verify than our F-15-based ASAT system?

Dr. IKLE. I could not give you a considered answer. What we now observe is the testing, and to the extent that they do need future testing—this is one of the things that we seem to observe—the testing to the extent that you could use testing prohibitions for verification, that might work, but then we would have to think of ways of concealing the tests and we would also have to think of new systems, new anti-satellite systems that may not require such observable tests.

Senator TSONGAS. Those problems are unlikely to be resolved prior to this summer or October or early 1984. Is that correct?

Dr. IKLE. Next year? I would think that by next year we would have a much more detailed assessment of the possibilities of verifying alternative antisatellite restrictions and looking in particular also at alternative technologies for attacking satellites.

Senator TSONGAS. So, assuming for the sake of argument that this information is correct, then the assessment will come in after at least two of the three American tests have been concluded.

Dr. IKLE. If you assume that there are such tests scheduled in the next few months and our assessment is to be finished or far enough along within a year, then you would be right. Then they would be after that point.

Senator TSONGAS. I think that is a very clear statement. At least we know where we stand.

Just one question on the so-called "Star Wars" defense system. If the United States were to spend x billions of dollars and deploy it the way some people have suggested, the President, for example, said, but what if free people could live secure in the knowledge that their security did not rest on the threat of instant U.S. retaliation to deter a Soviet attack, that we could intercept and destroy strategic ballistic missiles before they reached our own soil and that of our allies?

Let us say we decided to do that, and some clever Soviet decided well, if that is how they are going we will push cruise missiles, and let us say they developed x thousands of cruise missiles and deploy the submarine-based and bomber-based cruises against the United States and the land-based cruises against Europe and China, and let us say they launch 6,000. How many of those would be shot down by our "Star Wars" defensive system?

Dr. IKLE. Well, you have a rather different system against different principles for defense against ballistic missiles, as contrasted with defenses against so-called aerodynamic systems—cruise missiles or manned aircraft. As a very rough assessment, it might be said now that we see more possibilities for a given amount of effort to defend against ballistic missiles than for the same effort to defend against the aerodynamic threat.

Maybe that is fortunate because, as I explained earlier, it is politically the ballistic missile threat that is the most destabilizing one, and if you could eliminate that or sharply curtail it that is what you want to do first. Aircraft and cruise missiles take time from launch to target

and they are less suitable, therefore, for a surprise attack. They are, in that sense, more easily deterred against.

Now if you wanted to proceed further and defend against things that fly through the air you would go to rather different systems. The Soviet Union, of course, makes an immense effort on air defense systems. We have long abandoned those efforts and whether that should follow a capability for ballistic missile defense I should think would depend on the magnitude of the threat and again would depend on a point I made earlier, on the relative cost of overcoming these defenses by an adversary who does not want to cooperate versus the cost of improving the defenses.

Senator TSONGAS. Is it not true that the cost of adding on to cruise missiles is a lot cheaper than the counterpart defensive capability would cost?

Dr. IKLE. It depends on the particular technologies. We are working on new technologies that facilitate the penetration of our bombers and cruise missiles. That is why we are building the advanced technology bomber. And if the Soviet Union wants to further enhance its air defense systems to overcome that, their costs might be greater than our costs in building the more advanced bomber.

Whether that is the case indefinitely or with new technologies, I cannot predict.

Senator TSONGAS. So it is conceivable that the United States could spend, let us say, half a trillion dollars, which is the upper end of the estimates that I have seen—although the chairman would argue higher—and have arguably antiballistic missile capability and still be vulnerable to thousands of cruise missiles launched by submarine and by bombers against us.

So the President would get on television and say—whatever President—I am announcing today that we are safe from ICBM attack and we are secure, except for those 6,000 cruise missiles that we have not quite figured out what to do with.

Dr. IKLE. I think our stability or deterrence posture would be greatly enhanced if we could eliminate the ballistic missile threat. Obviously, you would not want to stop there and you would want, through arms control agreements and, if need be, further improvements in defensive systems, to reduce and eliminate the aerodynamic threat as well.

Senator TSONGAS. Would you say that it would be more difficult to design a defense system against the cruise missile type threat than the ICBM type threat?

Dr. IKLE. More costly would be, I guess, the point of your question. I made a guess earlier—it is a venturesome guess—that at this time, with present technologies, it looks more costly, although I must add that certain systems that are effective against ballistic missiles also can have some effectiveness against aerodynamic delivery vehicles. There is not total separation between these two types of defense.

Senator TSONGAS. So we would be talking about a phase I-phase II. Phase I, "Star Wars" against ICBM; phase II, "The Empire Strikes Back" against cruise missiles. And then somebody is going to figure out something else, and we have phase III, "The Return of the Jedi". Where is the end of all of this?

Dr. IKLE. That is your imagery, Senator. The President has initiated a research program to open up the doors again to a new avenue

in controlling the threat of the nuclear age—that is to say, to see whether we can defend against, complemented with arms control agreements, the offensive systems, or whether we have to forever remain locked into this threat of revenge and retaliation by the missile forces or, if you wish, by the cruise missile forces.

Senator TSONGAS. One final yes or no. General Lamberson, who is sitting behind you, is an expert on these kinds of systems. Was he aware of the President's speech before it was given?

Dr. IKLE. He was not, no. But the speech, of course, was discussed at the senior policy level and the President has received the advice of his military advisers. It would not surprise you, Senator, that when the President prepares a speech that not every official in all the departments that are affected by it would be involved in the final preparation of the text.

Senator TSONGAS. I would think the person who is most expert in it—

Dr. IKLE. The experts have been made available to comment on it, to advise the President.

Senator TSONGAS. Some of the people in the Pentagon have been quoted in Business Week and other publications about their surprise and chagrin at having been excluded and have this thing pop up at the last moment. I believe the general was testifying that day, the day of the speech, and had not been informed that the speech was going to be given, but that is a minor point.

Thank you, Mr. Chairman.

Senator PRESSLER. Mr. Ikle, we thank you.

We have a panel who have a press conference scheduled at 12:45. We also have another witness to hear. We thank you very much for your willingness to come and we will look forward to working with you.

Dr. IKLE. All right, Mr. Chairman. It was a pleasure to meet with the committee. I was wondering whether we should schedule a press conference at the same time to get our point across.

Senator PRESSLER. Well, you may participate. I am sure they would be glad to have you.

At this time we will hear from a panel of specialists created by the Union of Concerned Scientists—Dr. Richard Garwin, Admiral Gayler, and Dr. Gottfried.

In the interest of time, if we could ask you to summarize your statements, we have approximately 35 minutes before we have to bring this hearing to an end.

Mr. GOTTFRIED. How much time do we have, Mr. Chairman—total time?

Senator PRESSLER. I will ask my colleagues. Paul, you are the one with the time schedule. We have one more witness after this.

Senator TSONGAS. There are two possibilities. One is to start it now. We have a press conference at 12:45. We can always come back this afternoon. It is not for me to say. The other alternative is to wrap it up quickly.

Senator PRESSLER. If you could do it in 30 minutes, we could make it.

STATEMENT OF KURT GOTTFRIED, DIRECTOR, UNION OF CONCERNED SCIENTISTS, WASHINGTON, D.C.

Mr. GOTTFRIED. My name is Kurt Gottfried. I am testifying as a director of the Union of Concerned Scientists and as chairman of the

10-man panel that prepared the document that has been mentioned before. Dr. Garwin and Admiral Gayler will also describe this document to you.

I presume what you have said is that we could first give a condensed version of our prepared statement before we go into questions. Is that correct?

I will quickly say that we appreciate the opportunity to testify. We think that the resolutions put forward by all three Senators here in front of us today are worthy contributions to arms control in space. Admiral Gayler will present to you the arguments as to why we think that on balance the United States is more dependent on satellites than the Soviet Union.

It then follows that it is essential to place a firm lid on the further growth of Soviet antisatellite capability as quickly as possible. That can only be achieved by negotiation. What our panel, therefore, addressed itself to was to place a lid as quickly as possible through negotiation on the further evolution of ASAT capability. We were very much concerned with the kind of question that is posed by the picture of the F-15/ASAT shown several times by Senator Tsongas.

Therefore, our proposal is, first and foremost, a treaty banning the testing of antisatellite weapons. The crucial treaty provision can be summarized as follows: No weapon that can destroy, damage, render inoperable, or change the flight trajectory of space objects can be tested in space or against space objects.

In contrast to the 1981 Soviet draft treaty, our treaty would not permit the testing of ground-based ASATs against objects in space. Our proposal is not as comprehensive a restriction on space weapons as all of us would like to see, but a treaty that forbids possession, as you have pointed out several times, Senator Tsongas, presents very knotty problems of verification that require very lengthy negotiations.

We feel that such negotiations should be pursued after a ban on ASAT tests is in place. The compliance with the provisions of our treaty can be verified with adequate confidence.

As Dr. Garwin will argue, unrestricted competition in ASAT weaponry is much more dangerous than the tightly constrained growth of ASAT capability that may still be possible because of ambiguities in verification of our proposed treaty. Furthermore, he will argue that the residual risks can be reduced to an acceptable level by relatively inexpensive satellite defensive measures.

Now you have already asked whether the United States can afford to suspend the testing of its ASAT system while leaving the Soviets in possession of their tested system. We have compared the status and potential capabilities of both systems and conclude that an immediate moratorium on ASAT space tests would not jeopardize our security if negotiations were to fail, or if a treaty were eventually abrogated or circumvented by the Soviet Union.

In conclusion, I want to make the point that Senator Pressler made earlier, the remarkable parallel between the history of MIRV and the development of ASAT that we can see in front of us. The Soviets failed to foresee that we would develop MIRVs as a sophisticated response to their primitive missile defense of Moscow.

We, in turn, did not anticipate that our response would eventually boomerang by putting all our silo-based missiles at risk. Today, there is general agreement that we would have been far better off had we

abstained from introducing MIRVs. This lesson applies directly to antisatellite weapons.

The Soviets have been both foolish and reckless to spend some 15 years nurturing a clumsy threat against a rather small portion of our satellite. Their major accomplishment has been to provoke us into building a far more sophisticated system. Our ASAT, if deployed, will give us a temporary advantage.

But, as with ballistic missiles, an ongoing competition in space weaponry will, inexorably, reduce the security of both sides. That should be clear to everyone by now, I would hope. Or, do we have to wait for a presidential commission to tell us a decade from now that in 1983 the United States blundered yet again by upping the ante in the deadly poker game of nuclear war?

Thank you, Mr. Chairman.

[Mr. Gottfried's prepared statement and the report of the Union of Concerned Scientists follow:]

PREPARED STATEMENT OF KURT GOTTFRIED

Mr. Chairman, my name is Kurt Gottfried. I am testifying in my capacity as a Director of the Union of Concerned Scientists, and as chairman of the 10-member panel that prepared the document that Dr. Garwin, Admiral Gayler and I shall describe.

First, I wish to express the appreciation of the Union of Concerned Scientists, and of all members of our panel, to you and your Committee for giving us this chance to present our views. We also wish to applaud your initiative, Mr. Chairman, in putting forward Senate Resolution 43 calling for negotiations to ban anti-satellite weapons. We believe that your Resolution, as well as other Resolutions before both Houses with similar objectives, deserve the enthusiastic support of all Members of Congress.

I shall now summarize the document that we have submitted you. My colleagues will then discuss a number of important points in greater detail.

What we have to say is based on the recognition that, on balance, the United States is more dependent on satellites than the Soviet Union. Consequently, it is essential to place a firm lid on the further growth of Soviet anti-satellite capability as quickly as possible. This can only be achieved by negotiation.

Our panel therefore drafted a model treaty in full detail, and its text is in the document submitted to you. As we shall argue, if our treaty were in force, it would severely restrict the further evolution of ASAT technology, and greatly enhance the security of the United States. Hence the negotiation of such a treaty should be a high priority objective of U.S. foreign policy.

Our proposal is, first and foremost, a treaty banning the testing of anti-satellite weapons. The crucial treaty provisions may be summarized as follows:

No weapon that can destroy, damage, render inoperable, or change the flight trajectory of space objects can be tested in space, or against space objects.

In contrast to the 1981 Soviet draft treaty, our treaty would not permit the testing of ground-based ASATs against objects in space.

Our proposal is not as comprehensive a restriction on space weapons as we all would like to see, because it does not forbid the possession of ASAT weapons. But a treaty that forbids possession presents knotty problems of verification that would require lengthy negotiations. Such negotiations can be pursued after a ban on further ASAT tests is in place.

Compliance with the provisions of our treaty can be verified with adequate confidence. As Dr. Garwin will argue, unrestricted competition in ASAT weaponry is much more dangerous than the tightly constrained growth of ASAT capability that may still be possible because of ambiguities in verifying our proposed treaty. Furthermore, the residual risks can be reduced to an acceptable level by benign and relatively inexpensive satellite defenses.

One can ask whether the United States can afford to suspend testing of its ASAT system, while leaving the Soviets in possession of their tested system. We have compared the status and potential capabilities of both ASAT systems, and conclude that an immediate moratorium on ASAT space tests would not jeop-

ardize our security if negotiations were to fail, or if a treaty were eventually abrogated or circumvented by the Soviet Union.

In conclusion, it is important to note the striking parallel between today's competition in ASATs, and the history of MIRV. As is well known, the Soviets failed to foresee that we would develop multiple independently targetted warheads (MIRVs) as a sophisticated response to their primitive missile defense of Moscow. We, in turn, did not anticipate that our response would eventually boomerang by putting all our silo-based missiles at risk. Today, at long last, there is general agreement that we would have been far better off had we abstained from introducing MIRVs. This lesson applies directly to anti-satellite weapons. The Soviets have been both foolish and reckless to spend some 15 years nurturing a clumsy threat against a rather small portion of our satellites. Their major accomplishment has been to provoke us into building a far more sophisticated system. Our ASAT, if deployed, will give us a temporary advantage. But as with ballistic missiles, an ongoing competition in space weaponry will, inexorably, reduce the security of both sides. That should be clear to all by now. Or must we wait for a Presidential Commission to tell us a decade hence that in 1983 the United States blundered once again by upping the ante in this deadly poker game?

Kurt Gottfried has been a professor of physics and nuclear studies at Cornell University since 1968, and a member of the Board of Directors of the Union of Concerned Scientists since 1978. During 1970-73 he was a senior staff member of the European Organization for Nuclear Research (CERN) in Geneva. He has been the chairman of the Division of Particles and Fields of the American Physical Society, is a Fellow of the American Academy of Arts and Sciences, and serves on the executive committee of Scientists for Sakharov, Orlov and Shcharansky.

ANTI-SATELLITE WEAPONS: ARMS CONTROL OR ARMS RACE?

(A Report by the Union of Concerned Scientists, Cambridge, Massachusetts, May 11, 1983)

FOREWORD

This document was prepared by a panel organized under the auspices of the Union of Concerned Scientists. The participants were:

Kurt Gottfried, Panel Chairman, member, Board of Directors, UCS; Professor of Physics, Cornell University; former Chairman, Division of Particles and Fields, American Physical Society.

Hans A. Bethe, Professor of Physics Emeritus, Cornell University; Nobel Laureate in Physics; Chief, Theoretical Division, Manhattan Project; member, President's Scientific Advisory Committee (1957-60); Strategic Military Panel (1957-69).

Richard L. Garwin, IBM Fellow at the Thomas J. Watson Research Center; member President's Science Advisory Committee (1962-65) and (1969-72); member, Defense Science Board (1966-69).

Noel Gayler (Admiral, USN, Ret.), former Director, National Security Agency; former Commander in Chief, U.S. Forces in the Pacific; former Deputy Chief of Naval Operations (Research and Development).

Henry W. Kendall, chairman, Board of Directors, UCS; Professor of Physics, Massachusetts Institute of Technology.

Franklin A. Long, Professor Chemistry Emeritus, Cornell University; former Associate Director, U.S. Arms Control and Disarmament Agency.

Leonard C. Meeker, member, Board of Directors, UCS; U.S. Ambassador to Romania (1969-73); Legal Advisor to the Department of State (1965-69).

Carl Sagan, Professor of Astronomy and Space Sciences and Director, Laboratory for Planetary Studies, Cornell University.

Herbert Scoville, Jr., Deputy Director, Research, Central Intelligence Agency (1955-1963); President, Arms Control Association.

John Steinbruner, Director of Foreign Policy Studies, Brookings Institution, 1978-present; Associate Professor of Organization and Management at Yale, 1976-1978.

(The affiliations listed are for purposes of identification only.)

EXECUTIVE SUMMARY

It is in the long-term security interest of both superpowers to summarize the likelihood of conflict in space. This is especially true of the United States, since, on balance, it is more dependent on space-based systems than is the Soviet Union. Tight constraints on potential threats from Soviet anti-satellite (ASAT) weapons should therefore be a high priority objective of U.S. foreign policy. Such constraints can only be achieved by negotiation, not by preparations for attacking Soviet satellites.

This document argues that effective constraints on ASAT development and deployment are both highly desirable and achievable by negotiation. An explicit bilateral treaty text is proposed, so as to focus attention on the issues that such negotiations are likely to encounter. Under this treaty's provision, the signatories could not destroy, damage, render inoperable, or change the flight trajectories of space objects, nor could they test in space, or against space objects, weapons having such capabilities. Compliance with the treaty would be verified by national technical means.

Because the treaty's principal objective is the prevention of flight tests of ASATs, and not their mere possession, an examination of testing procedures and surveillance capabilities shows that the treaty can be adequately verified.

The likely evolution of ASAT technology in the next five to ten years is described under the assumption of no negotiated constraints. It is concluded that the hazards of a totally unconstrained competition in space weaponry are far greater than those posed by the tightly constrained evolution of ASAT capability that may be possible because of ambiguities in verification. These residual risks can be reduced to acceptable levels by a program for satellite defense at much less cost than the program that would be necessary in the absence of negotiation constraints.

Finally, it is argued that the relative status and potential capabilities of the current United States and Soviet ASAT systems make it advantageous for the United States to agree to an immediate joint moratorium on further ASAT space tests, and that the security of the United States would not be in jeopardy should such negotiations fail, or should a treaty be abrogated or circumvented by the Soviet Union.

I. Introduction

Satellites give the United States prompt, precise, and irreplaceable intelligence about Soviet strategic forces. They provide an invaluable view of many other aspects of Soviet military capabilities and activities. In a crisis they would allow each side to watch the movements of the other, and thereby to gauge its objectives and apprehensions. If hostilities were ever to break out between the superpowers, whatever hope there would be for controlling the conflict and bringing it to an early end would largely rest on satellite surveillance, on the command of strategic forces via satellites, and on satellite communication between the adversaries.

But satellites are two-edged swords. They have a beneficial role in arms control, confidence building, and conflict resolution, but their unique ability to see, to hear, and to communicate greatly amplifies the effectiveness of the military forces that they serve. Hence they become exceptionally tempting targets as soon as hostilities are about to begin.

In the 1960's both the United States and the Soviet Union fielded systems having anti-satellite (ASAT) capabilities. The United States eventually dismantled its ASAT systems, and adopted the position that its national security would be best served by abstaining from competition in ASAT weaponry. The Soviet Union, on the other hand, continued sporadic testing of a rather primitive device that can attack objects in low earth orbits.

By the latter part of the 1970's the United States altered its approach, though a weapon-free space environment continued to be its goal.¹ The new tactics had both a military and a diplomatic component: a program to develop a satellite interceptor, and simultaneous negotiations towards a treaty that would ban the testing and deployment of ASAT weapons. These negotiations did not reach frui-

¹ Presidential Directive 37, as summarized in a White House fact sheet dated June 19, 1978.

tion in the last Administration,² and have not been pursued since then.³ In the interim, both superpowers' ASAT programs have continued apace.⁴

In August 1981 the Soviet Union submitted to the United Nations a draft treaty calling for a "prohibition on the stationing of weapons of any kind in outer space." The United States has not responded to this initiative, nor has it offered any rationale for its failure to respond. If the United States continues to forego negotiations, it will have a new strategy of ongoing confrontation for protecting its space assets. An era of strenuous competition in space weaponry will have begun, and even if one competitor does, on occasion, enjoy a fleeting advantage, the national security of both rivals will inexorably erode. Any threat to satellites, whether real or potential, will undermine confidence in the ability to deter attack. By the same token, an awareness that satellites are at risk will tend to destabilize a crisis. Even in times of peace, a keen rivalry in the development and testing of ASAT weapons is certain to cause friction, increase suspicions, undermine confidence in the ability to deter attack, and, perhaps, inadvertently spark a conflict. Finally, should ASAT technologies evolve to a level of potential ABM capability, there would be far-reaching and unfortunate implications for strategic stability.

It does not take great powers of prophesy to predict this erosion of security, for the analogy with the history of MIRV technology is both instructive and disturbing. In that case the Soviet Union failed to foresee that the United States would develop MIRVs as a sophisticated response to a primitive ballistic missile defense of Moscow. Neither did the United States anticipate that the strategic benefit that it achieved with MIRVs would eventually boomerang by putting at risk U.S. silo-based missiles. Today, finally, there is a broad consensus that strategic stability and Alliance cohesion would have fared better had the United States abstained from introducing MIRVs. Nevertheless, there is a strange reluctance to recognize that this painful lesson applies directly to current trends in the arms competition in space.

It is in the long-term interest of both superpowers to minimize the likelihood of conflict in space. This is especially true for the United States. Some Soviet satellites do pose a direct threat to certain U.S. military forces, but these threats can be countered without ASATs. Because the United States is more dependent on space-based systems than the Soviet Union, it is better, on balance, for the United States to constrain the potential threat from Soviet ASATs than to prepare to attack Soviet satellites. Such constraints can only be achieved by negotiations that build on the established body of international law represented by the Test Ban Treaty, which forbids nuclear explosions in outer space, the Outer Space Treaty, which bans space-based weapons of mass destruction, and the ABM Treaty, which bans space-based ABM systems and which protects satellites serving as "national means of verification."

Aside from these considerations that arise from a strictly military conception of national security, political factors of considerable weight also provide a strong incentive for negotiations. In the United Nations General Assembly the allies of the United States proposed a resolution requesting the U.N. Committee on Disarmament to "consider as a matter of priority the question of negotiating an effective and verifiable agreement to prohibit anti-satellite systems." There is every indication that the Western allies of the United States will, in the U.N. General Assembly, propose that matters move from "considering the question of negotiating" to actual negotiations.

The United States, through its silence on the Soviet proposal, has in effect allowed the Soviet draft treaty to set the agenda for the international discussion of this issue. This is hardly a sound posture for the leader of the Western Alliance, and the world's preeminent military and civilian space power. Whether the diplomatic and military objectives of the United States are being furthered by current policy has also been brought into question by resolutions introduced

² Robert W. Buchheim, testimony at hearing on "Arms Control and the Militarization of Space" held by the Subcommittee on Arms Control, Oceans, International Operations and Environment of the Senate Foreign Relations Committee, September 20, 1982.

³ Eugene Rostow, testimony at same hearings.

⁴ Richard D. DeLauer, testimony at same hearings. Robert S. Cooper, testimony to the Subcommittee on Research and Development of the House Armed Services Committee, March 17, 1983.

Marcia Smith, "Antisatellites," Issue Brief No. IB81123, Science Policy Research Division, Congressional Research Service, Library of Congress, April 6, 1983.

in the Senate and House calling for negotiations and for a moratorium on the *Sight testing of weapons in space*.⁵

We believe that a negotiated ban on using, testing, and stationing anti-satellite weapons in outer space is not only desirable but feasible. To this end, we put forward an explicit treaty text so as to focus attention on issues that such negotiations are likely to encounter. We examine the problem of verifying compliance with the treaty's provisions. We conclude that the hazards of a totally uninhibited competition in space weaponry are far greater than those posed by the tightly constrained evolution of ASAT capability that may be possible because of ambiguities in verification. We show that these residual risks can be reduced to acceptable levels by satellite defense measures (such as decoy satellites, etc.) which would cost much less than the program that would be necessary if there were no negotiated restraints.

Finally, we argue that the relative status and potential capabilities of the current United States and Soviet ASAT systems are such that it would be advantageous for the United States to agree to an immediate moratorium on further ASAT space tests, and that the security of the United States would not be in jeopardy should such negotiations fail, or should a treaty be abrogated or circumvented by the Soviet Union.

II. Current United States and Soviet space assets and ASAT systems

Negotiations towards restraints on further ASAT development must take into account the existing balance in the United States and Soviet space assets and military capabilities.

Secure long-range communications are essential to U.S. security, since U.S. forces are spread across the globe. For that reason approximately 70 percent of long-haul military communications now go via satellites; there are no facilities on the earth's surface that provide a satisfactory replacement for this system. The Soviet Union's military forces are mainly on the Eurasian land mass, and can, if necessary, communicate without the help of satellites.

The vulnerability of a satellite to attack is largely determined by the nature of its orbit. These fall into several categories: geosynchronous (GEO) orbits, in which the satellite is stationary above a point on the earth's equator at an altitude of about 22,000 miles; semi-synchronous orbits, with altitudes in the range of 12,000 miles; and low-earth (LEO) orbits, at altitudes up to about 1,000 miles. Satellites can also be in highly elliptical orbits that dip as low as several hundred miles and rise as high as geosynchronous. Some U.S. satellites are in orbits that are considerably higher than geosynchronous.

The existing Soviet ASAT interceptor is launched by a ground based SS-9 missile into an orbit close to that of its target. The interceptor then crosses the path of its target after one or two orbital revolutions, whereupon its nonnuclear warhead explodes, and the resultant shrapnel destroys the target satellite.

The highest altitude reached thus far by the Soviet interceptor is reported to be about 1,400 miles. It would appear to be difficult to modify the Soviet system so that it could threaten targets in far higher orbits. The resulting weapon would surely be a cumbersome ASAT. Therefore, the current Soviet system only threatens low-orbit space objects. About a third of all U.S. satellites fall into this category, and their most important national security functions are photographic and electronic surveillance of the earth's surface. U.S. satellites responsible for early warning, nuclear attack assessment, additional electronic intelligence, and military communications are in very high orbits, and not vulnerable to the current Soviet ASAT.

The U.S. ASAT system is based on quite different principles. The interceptor is the so-called Miniature Homing Vehicle (MHV), which is carried into space on a two-stage rocket that in turn is launched from a high altitude F-15 fighter plane. The MHV is a small cylinder with a diameter of about one foot that seeks its target by a combination of infrared telescopes, a laser gyroscope, and a set of small jets that can alter its trajectory. It destroys by direct impact at very high velocity. In its present form the MHV cannot reach geosynchronous satellites, but this is not of great consequence at this time, because almost all Soviet satellites are in low or highly elliptical orbits. By using a three-stage booster the U.S. system should be able to attack geosynchronous targets.

⁵ S. Res. 43, introduced by Senator Pressler on February 2, 1983. H.J. Res. 120, introduced by Representative Moakley on February 2, 1983. S.J. Res. 28, introduced by Senator Tsongas on February 3, 1983.

The Soviet ASAT has been tested some twenty times since 1968, and it is reported that about half of these tests have been successful. Launches of the U.S. interceptor from an F-15 to a point in space are scheduled for later this summer, but tests against space targets are not scheduled until late in 1983 or early 1984.

These facts allow us to draw up a current balance sheet:

The Soviet ASAT system is deemed to be operational by the Department of Defense, whereas the U.S. system is now ready for flight testing.

The Soviet Union has most of its space-based assets in low earth (LEO) orbits, while the United States has many of its most important satellites in geosynchronous (GEO) orbits.

The Soviet ASAT can only attack targets in low-earth orbits, and would require a very large booster to carry it up to geosynchronous targets (see Section 4). The U.S. interceptor could, with a three-stage booster, reach geosynchronous targets.

The Soviet ASAT, which uses fixed launch sites, is a cumbersome and inflexible system in comparison to the mobile, F-15 based U.S. system.

These comparisons lie behind our contention that the United States risks little if both nations' ASAT development programs were to be suspended at this time, while negotiations take place. If, for one reason or another, the United States would find it necessary to resume its development program, it could look forward to having an operating system within a year or two. The Soviet ASAT system, though it is now deemed to be operational, only poses a rather clumsy threat to a portion of U.S. space systems, and it has little potential for attacking the warning, communication, and navigation satellites on which U.S. strategic forces depend.

In short, if negotiations fail, or arms control in space were to break down, the United States would not find itself in a disadvantageous position.

III. A treaty limiting ASAT weapons

The full text of the treaty put forward here is to be found in the Appendix. Here we shall summarize the goals this treaty sets out to achieve. The differences between our proposal and the 1981 Soviet draft treaty are discussed briefly here, and analyzed more fully in Section 6.

The proposed treaty has three essential ingredients:

The signatories would undertake not to destroy, damage, render inoperable or change the flight trajectories of space objects.*

The signatories would undertake not to test in space or against space objects weapons for destroying, damaging, rendering inoperable, or changing the flight trajectories of space objects. Furthermore, the signatories would undertake not to place such weapons in orbit or to station them on celestial bodies or in outer space in any other manner.

Compliance would be verified by national technical means, enhanced by cooperative measures and buttressed by collateral constraints on other space activities to prevent circumvention of the treaty's provisions.

The treaty proposed here formulates restrictions and prohibitions in general terms. Excessive detail in an arms control accord may inadvertently leave loopholes and convey the impression that activities and weapons not explicitly prohibited are therefore permitted. A treaty weighted down with excessive detail may also prove inflexible in coping with new circumstances, and unanticipated technological developments. Our purpose in presenting general treaty provisions here is to provide a focus for discussion of feasible and desirable restrictions on ASAT weapons. In actual bilateral negotiations, the United States and the Soviet Union could incorporate more detailed language into the final treaty text that reflects the best advice and wisdom that consultations within each government would provide.

The text put forward here is for a bilateral treaty. However, once agreement between the United States and Soviet Union is reached, a multilateral accord open to all nations would be desirable.

*The term "space objects" would correspond to "objects launched into outer space" in the Outer Space Treaty of 1967. Such objects include not only all functioning objects commonly called "satellites," but also all objects on interplanetary flights as well as all man-made pieces of debris. The term does not include nuclear missile warheads on ballistic trajectories, even though these pass through space. Hence, an ASAT treaty along these lines would not alter the rights or obligations prescribed by the 1972 ABM Treaty which covers weapons used against ballistic missiles.

We note that our proposal is not the most comprehensive limitation on space weapons possible, for a treaty could also forbid any possession of such weapons, and require that those already constructed be dismantled or destroyed. Such a comprehensive ban is what the United States evidently sought in the negotiations of 1978-79.

There is much to be said in favor of such a comprehensive ban, but it also poses formidable verification problems that could only be resolved by protracted negotiations. To avert further arms competition in outer space as promptly as possible, a ban on further tests in space of ASAT weapons must take priority, and the proposed treaty addresses itself to this urgent objective. Subsequent negotiations that face the knotty problems of verifying a more comprehensive ASAT ban could then be pursued in an atmosphere free of the tensions that would be created by a simultaneous competition in space weaponry.

In contrast to the 1981 Soviet draft treaty, which only speaks of weapons in orbit, the treaty proposed here does not allow the use or testing of ASAT weapons whether they are ground- or space-based. Furthermore, our proposed treaty forbids the sides from destroying any space objects (including one's own), whereas the Soviet draft only forbids attacks on space objects of other states. Indeed, the Soviet draft treaty does not appear to limit further testing or development of the current Soviet or U.S. ASAT systems. In space tests, the Soviet interceptor goes into earth orbit before attacking its target. But it may well be able to attack satellites by direct ascent from the ground, or after only a partial earth orbit, and thus it may elude a ban on weapons "placed in orbit." The U.S. ASAT system uses a direct-ascent interceptor and never goes into earth orbit.

A ban on the use and testing in space of ASAT weapons cannot, by itself, protect satellites. Nevertheless, the ban on testing would provide a severe impediment to the further development of ever more capable ASAT weapons. For the foreseeable future the military and civilian branches of the United States Government are likely to remain at least as virtually dependent on satellites as they are already. It is therefore in the long-term security interest of the United States to enhance the survival of its space assets as much as possible, and to achieve this goal with as little friction and cost as it can.

IV. The ASAT threat with and without a treaty

The value of a ban on ASAT space tests is best measured by looking ahead to the variety of ASAT threats that can be expected in the next 5 to 10 years if there are no further restraints on weapons competition in outer space. In that period the total number of American satellites will increase to about 100, with approximately one-third of these in low earth (LEO) orbits, about one-fifth in semi-synchronous orbits, and about one-third in geosynchronous (GEO) orbits. The others will be in highly-elliptical orbits that may dip as low as several hundred miles but also rise as high as geosynchronous orbits.

If the Soviets are free to continue ASAT development, we may anticipate the following course of space weapons competition. The first Soviet move might be to improve their current interceptor, so that it could reach higher altitudes and defeat potential U.S. satellite defense measures, such as radar jammers, decoys, and evasion. Tests of the current Soviet interceptor up to geosynchronous orbits might be feasible within relatively few years, if the Soviets set themselves to it. This would mean matching the interceptor to a new booster, such as the liquid-fueled PROTON or A-2 rockets used to orbit the Salyut and Soyuz space vehicles. The whole system would require testing against space targets to confirm that it worked, and the long launch preparations needed for such massive boosters would make this a very cumbersome ASAT.

Alternatively, the Soviets could pursue a more promising ASAT development program along one or more of at least three paths: a more agile miniature ASAT interceptor, such as the United States is developing, that could reach all altitudes with smaller boosters; a more exotic orbiting laser ASAT; or space mines. (A space mine is a small satellite that carries an explosive charge and is placed in an orbit so as to follow closely its potential target.) Debate persists over the feasibility and cost of space-based lasers, but there is no question that both sides are vigorously developing them. According to Air Force Chief of Research and Development, Gen. Kelley Burke, the Soviets are believed capable of launching a laser ASAT of limited effectiveness within 5 years, and a more effective system perhaps in the 1990's. In keeping with their accustomed practice, the Soviets may well develop and deploy a mix of ASAT weapons, each posing a different threat to U.S. satellites: improved ground-based interceptors and lasers for lower orbit

attacks, space-based lasers for higher orbits, and space mines for geosynchronous attacks. Along the way, the number of launch sites would be increased, inventories of ready-to-fire ASAT weapons would multiply, and all U.S. satellites would become progressively more vulnerable to attack.

The United States has already mapped out its initial moves in this competition. In the beginning, it will incorporate defenses on satellites, and deploy the sophisticated F-15 ASAT MHV interceptor described in Section 2. Ground- and air-based lasers would provide additional ASAT capability against low-orbit satellites while helping to solve technical problems in the development of space-based lasers. A "defensive" space-based laser weapon would be the next step—an ASAT deployed to attack Soviet ASATs. At this stage, the scene might recall the battleship competitions of an earlier era, as each side strives for the competitive edge of just a bit more firepower, longer range, thicker armor, larger fleets.

Under such unrestrained ASAT competition, the advantage will almost certainly go to the offense. A duel between a sophisticated ASAT weapon devised for the sole task of killing, and a satellite built for other purposes and only incidentally equipped to defend itself, will always be a mismatch. Moreover, U.S. satellites are designed for lifetimes of 5-10 years, so the defenses they carry with them into space on the day of launch stand a good chance of being nullified by a rapidly-changing ASAT environment. Soviet satellites have much shorter lifetimes, are therefore more frequently replaced, and could be more readily modified to counter U.S. ASAT developments.

In confrontations in a world filled with ASATs, fear of a preemptive strike will run high, and the very process of unlimbering ASATs for possible use would drive tensions higher. Since attacks on satellites would be a possible opening step in war, even inadvertent events in space may be mistaken as a signal that war has begun. The sheer multiplicity of ASATs would also raise the likelihood of such an inadvertent occurrence. Such events have happened. For example, in 1975 there was concern that U.S. early-warning satellites had been attacked by Soviet infrared lasers; later it was established that these satellites had only observed infrared radiation from a Soviet natural gas pipeline fire.

Were a satisfactory ASAT arms control agreement in force, the future would look quite different. As matters stand now, only a fraction of U.S. satellites are exposed to the rudimentary Soviet ASAT system. Under a general ban on tests of ASAT systems in space, Soviet efforts to improve their current interceptor or to devise a new one should be blunted. Tests or use of lasers or high-powered transmitters to damage satellite sensors or to burn out satellite receivers would be banned. In contrast, under unrestrained ASAT competition, protecting American satellites through hardening, maneuvering, deception, etc., against ever more sophisticated and nimble Soviet ASATs, will become untenable. Exotic laser ASATs may well prove infeasible in the near future, but the Soviets would still be free to duplicate the U.S. miniature ASAT interceptor and threaten American satellites at all altitudes. Five to ten years from now, after successive rounds of unrestrained competition, the security of U.S. satellites, and thereby of the United States, will have been seriously impaired, despite greatly increased expenditures. In sum, the contrast between a future with ASAT arms control, and one without, is stark.

A ban on space tests of ASATs could also buttress the arms control achievements of the 1972 ABM Treaty. The ASAT limitations proposed here would not ban any ABM activity already permitted to both sides in the ABM Treaty. Thus, an ASAT accord would not be incompatible with the President's recently announced intention to investigate advanced ABM defenses within the provisions of the ABM agreement. However, by banning all ASAT tests in space, an ASAT Treaty would prevent the Soviets from conducting impermissible ABM tests in space under the guise of devising an ASAT system.

It is to be hoped that an initial ban on ASAT tests could soon be augmented by a wider agreement to dismantle ASATs. Until such time as a comprehensive ban on possession of ASAT systems could be negotiated, there would still be a limited Soviet ASAT threat to those U.S. satellites within reach of the current Soviet interceptor. It would be doing arms control a disservice to claim that ASAT arms control alone could protect all space assets. (By the same token, extravagant claims that acquiring ASAT weapons will solve all our problems are equally mistaken.) What ASAT limitations could do is to make the task of protecting satellites less difficult, more reliable, and thus enhance confidence in the survival of satellites vital to U.S. security. ASAT arms control, then, serves American security interests by being an indispensable adjunct to, and not a replacement for, U.S. programs to diversify its satellite functions and harden its satellites against attacks.

Under a general ban on space tests of ASATs, the United States would also have to forego tests in space of the ASAT interceptor it is now developing. The United States reportedly is set to begin tests of its interceptor in space and against space targets within the year. If an ASAT accord were reached promptly, or if the United States offered to improve the prospects for successful negotiations by a voluntary test moratorium, the outcome might be that the United States would have no test experience with its ASAT in space, while the Soviets would have conducted some 20 tests over the past 15 years. But there are compensations that must be weighed. The Soviet's ASAT test program has not been a great success, with the interceptor failing perhaps half the time. The United States has already accumulated a body of test and engineering experience just short of tests in space, so it would not be left with a blank slate. Furthermore, unless the United States closes off further ASAT testing soon, it risks exposing all its vital satellites to possible improvements in the Soviet ASAT system, improvements that might require years of American effort and billions of dollars to then offset.

In agreeing not to use ASATs, the United States would also forego one of the stated purposes for buying its ASAT system: attacking Soviet satellites that can be used to target U.S. military forces. The principal satellites of concern are the Soviet Radar Ocean Reconnaissance Satellites (RORSATs) and Electronic Ocean Reconnaissance Satellites (EORSATs) that can locate ships at sea. It is important to weigh whether this limitation would significantly compromise American security.

To begin with, giving up ASATs does not mean giving up all means of countering Soviet satellites capability. Nothing in the treaty proposed here would prevent U.S. forces from using other countermeasures to deceive or confuse Soviet satellites, such as decoys, camouflage, electronic countermeasures, etc.

Second, ASATs may not in fact provide much protection for U.S. military forces. The Soviets have a variety of sea-based and airborne reconnaissance and targeting systems, so that shooting down Soviet satellites would not eliminate the threat. Any U.S. forces designed to operate along the periphery of the Soviet Union, where U.S. alliance obligations are, must be equipped with an array of countermeasures and defenses in any case. Third, if the Soviets are the ones to initiate hostilities, they will have been able to gather and pass along satellite information needed to target U.S. forces before conflict starts. The United States would be inhibited from preemptively shooting down Soviet satellites just on suspicion of Soviet intentions; doing so would certainly provoke hostilities. And for some time after hostilities break out, the Soviets may also be able to launch new satellites to replace those destroyed by a U.S. ASAT, so that again U.S. military forces must be prepared to fend for themselves in the face of threatening Soviet satellites.

Finally, U.S. military forces (with the exception of submarines) cannot count indefinitely upon concealment for their survival. They must be prepared sooner or later to withstand the brunt of Soviet forces. A U.S. ASAT system cannot protect an aircraft carrier, once it is discovered, by shooting down Soviet anti-ship missiles or intercepting torpedoes. But the U.S. ASAT program diverts resources and funds from other defense programs vital to our forces. According to the General Accounting Office, the U.S. ASAT program is already slated to cost \$3.6 billion; the GAO argues that the cost could well rise to "tens of billions." Even at \$3.6 billion, the "opportunity cost" of the ASAT system already equals one Nimitz-class nuclear-powered aircraft carrier. Where such trade-offs are involved, an ASAT system is not an incidental option, but potentially a major drain upon overall U.S. military preparedness.

The most important concern for the United States is to ensure that its satellites can carry out their tasks, even in crisis or conflict. Using an ASAT to shoot down Soviet satellites would not protect or restore U.S. satellites. It is occasionally argued, as justification for the U.S. ASAT program, that our own ASAT can deter Soviet ASAT attacks by the threat of a tit-for-tat response. Given the greater American dependence upon satellites, the United States might in fact only make its situation worse by such tit-for-tat exchange. The best "deterrent" to Soviet ASAT attacks is Soviet awareness that U.S. satellite functions are so well diversified and hardened, and so supplemented by non-satellite systems, that no attack on satellites could succeed in crippling the overall U.S. military capability. An American ASAT system contributes nothing to this "deterrent;" it promises only to divert funds from the countermeasures that would genuinely provide such security.

V. Verification and residual risks

It has been argued that ASAT arms control poses daunting, perhaps even insuperable, verification problems, more so than any other area of arms control. One reason offered for this is that space satellites are so few in number, and their unique capabilities so difficult to duplicate with ground-based alternatives, that even a few ASAT weapons covertly acquired in violation of an agreement could reward the cheater with significant military advantage in a conflict. It is additionally argued that any limitations upon weapons or space programs that would be comprehensive enough to close off such cheating would necessarily be so stringent that they would preclude many civilian uses of outer space. As an illustration, the Soviet Progrez resupply vehicles, used with the Salyut program, obviously have features in common with ASAT interceptors; they can be launched to the vicinity of an orbiting satellite, maneuvered alongside, and brought into contact. Yet banning them, or limiting all such maneuvering space vehicles, in order to prevent them from being configured as ASAT weapons, would impair not only the Salyut program but the U.S. Space Shuttle as well. The problems are multiplied if we also consider the ASAT potential of other weapons not specifically designed as ASATs, such as ground-based ABM interceptor missiles, or nuclear-tipped ICBMs, or exotic directed-energy air defenses.

These arguments point to genuine concerns the United States ought to have about the survivability of its satellites. At the same time, these arguments assume that the future is dictated by past errors. In the past, the United States coped with limited budgets and high launching costs (hundreds, even thousands of dollars per pound to place objects in orbit) by relying on relatively few, long-lived, equipment-crammed satellites to perform vital military tasks. Little effort was made to incorporate survivability measures or to diversify functions. Because of their design and budgeting constraints, U.S. satellites are even vulnerable to primitive ASAT weapons.

But with or without ASAT arms control, the United States cannot go on like this. Nor does it intend to. A Presidential Directive in May 1978 ordered that all future U.S. military satellites be equipped with survivability measures and devices for detecting ASAT attacks. Some satellites probably cannot be protected from attacks at any affordable cost (e.g., large and fragile low-orbit satellites); and some attacks may work against almost any satellite (e.g., nuclear warheads detonated near a satellite). The best approach to reducing the risk is to move to a larger number of simpler, easily-replaced satellites that are much more readily confused with decoys. Yet even this technique will succeed only if the Soviets are prevented from developing a cheap, nimble ASAT system capable of promptly attacking great numbers of satellites. It is precisely this sort of development that an ASAT arms control agreement should prevent.

There are several verification tasks that must be tackled under a general ban on ASAT weapons tests and use. The United States would have to confirm that the existing Soviet ASAT interceptor was not being tested in space; that no new ASAT weapons were being devised and tested in space or against space targets, including such new exotic ASATs as ground- or air-based lasers that could be aimed at low-orbit satellites; that weapons originally designed and deployed for other missions were not being tested in an ASAT mode; and that non-weapon space vehicles and programs were not posing significant ASAT threats.

The United States already has a diverse array of intelligence and space surveillance facilities for keeping track of Soviet activities, and this array is being expanded. NORAD's Space Object Catalogue is constantly being updated to record the identity and current orbits of all space objects (several thousand in all, of which several hundred are active or defunct satellites). NORAD's space tracking radar network has recently been upgraded to provide greater tracking accuracy, and gaps in the network have been closed by installing and improving radars in the Pacific. The GEODSS (Ground-based Electro-Optical Deep Space Surveillance) system, when completed in 1987, will augment ground radars and provide precise, highly-detailed optical and orbital signature data on man-made objects approximately 3,000 miles from earth and beyond. Upgraded radars in the United States, Turkey, and Kwajalein will provide additional tracking of objects in geosynchronous orbits.

Other electronic and optical sensors deployed around and over the Soviet Union add to United States ability to detect and classify Soviet missile and space launches. The potential for monitoring activities in outer space from space must

also be considered. The recent demonstration of what is possible, in inspecting damaged and missing thermal tiles on the first Space Shuttle flight in April 1981, hints at what might be routinely feasible. On occasion, critiques of space verification capabilities tend to match only current monitoring capacities against future conceivable but nonexistent ASAT weapons, and not surprisingly, come to pessimistic conclusions. More imaginative evaluations should consider what we could now do but have not funded, as well as potential innovations in monitoring capabilities.

The effectiveness of all the monitoring facilities would be enhanced under an arms control agreement by provisions, such as those included in prior accords, prohibiting interference with national technical means of verification and deliberate concealment which impedes verification. Since the Soviets have already agreed in principle that arms control accords may include cooperative measures contributing to the effectiveness of verification by national technical means (in the SALT II Joint Statement of Principles), these too should be exploited to improve confidence in verification.

The United States already has long monitoring experience with tests of the current Soviet ASAT interceptor, going back a decade and a half. Covert tests of that weapon would be rather risky for the Soviets. Conceivably the Soviets might try to test their current ASAT covertly in some radically different manner that expanded its capabilities, e.g., on a new booster capable of intercepts significantly higher than its present ceiling. This would not be a "nimble" threat, even in the unlikely event that cheating succeeded. The booster required to loft the Soviet's bulky ASAT up to geosynchronous altitudes would have to be comparable to the large U.S. Saturn 1B or the Soviet PROTON booster, massive rockets with long preparation times, whose launches would be unmistakable.

More likely, if the Soviets hoped to expand their ASAT capability covertly, they would attempt an entirely new weapon, such as a miniature homing ASAT, or a more exotic laser ASAT, or space mines. Until such time as ASATs are banned altogether, neither side would be violating the limitations if they devised such systems on the ground; they would be banned from testing them in space or against space objects.

But the technological challenges in building an effective space-based laser ASAT are formidable, even if unrestricted testing in space were permitted, and doing it all covertly would certainly be a protracted, highly risky task. To prevent the Soviets from testing ASATs in space under the pretense of developing, for instance, a space-based laser anti-aircraft defense system, our draft treaty also bans space weapons for damaging or destroying objects in the atmosphere or on the ground. This prohibition would also reinforce existing limitations on space weapons in the 1967 Outer Space Treaty and the 1972 ABM Treaty.

Ground- or air-based laser ASATs are far easier to construct than space-based lasers, but it is not clear that they offer any advantages over current ASATs. Such lasers could impair unprotected satellite sensors at high altitudes, but could only destroy satellites in low orbits. Whether Soviet technology is sufficiently far advanced to make a miniature homing ASAT feasible in the near term is not clear. In all these new ASATs, however, very high accuracies in homing or aiming would be necessary, and these would be difficult to confirm without actual tests against space targets. Such tests can leave a host of telltale signs: launch of the ASAT itself; a large flow of data from the test vehicles that the Soviets would have to transmit; damage to the target that causes it to fragment or tumble; intense heating that can be detected by infrared sensors; and displacement of the target's orbit. While the Soviets were pressing ahead with such innovations, there would, of course, be a parallel expansion and evolution of U.S. monitoring facilities, which would further facilitate detection of cheating.

Space mines placed in orbit near targets and detonated only when conflict begins are another problem. They seem ingeniously simple. The technology could perhaps be fairly primitive, and if the only tests required were triggering the explosive upon command, they could be amply tested on earth. Nevertheless, if covertly deployed, they might give themselves away or pose only a manageable threat. The orbital paths of satellites are not necessarily stable, especially those of satellites in lower orbits that are subject to atmospheric drag, or that maneuver to perform their missions. Space mines dogging along behind such maneuvering satellites would be bound to raise suspicions, and the mine ceases to be such a simple device if it must be equipped with homing and maneuvering capabilities so it can keep track of its potential target, or be able to close in rapidly on command. At geosynchronous altitudes, where all orbits are more stable, a space

mine skulking near its target could still arouse suspicions, since all legitimate satellites are supposed to be registered (under the 1975 Convention on Registration of Objects Launched into Outer Space) and are to maintain minimum separation distances in geosynchronous orbits. Again, a space mine becomes a complex device if it must pretend to be something benign when far away from its target to avoid suspicions, yet can swiftly seek its target upon command.

When it comes to verifying that non-ASAT weapons are not being put to ASAT purposes, long U.S. experience at monitoring the characteristic patterns of Soviet ICBM and ABM tests would also make it risky for the Soviets to test these weapons in an ASAT mode. Of course, even in the absence of tests, such weapons would still have to be taken into account as an ASAT threat, since the great kill-distance of nuclear explosions in space could compensate for deficiencies in guidance systems or test experience. But it is also true that present ABM interceptors can reach satellites only in the lowest orbits, and any nuclear explosion in space carries a grave risk of escalation, of damage to "friendly" satellites as well as the target, and of uncertain EMP effects upon other military and civilian systems on earth. So, while such residual ASAT threats are less awesome than what unrestricted ASAT competition would produce, they would persist, even if the ability to verify a test ban were perfect. They call for continuing vigorous satellite survivability programs as an adjunct to ASAT arms control.

Some non-weapon space vehicles may also have inherent ASAT capability (e.g., resupply vehicles that can home in on other satellites), and the United States would want to verify that such vehicles were not being tested in an ASAT mode. The overlap of non-weapon space technology with ASAT missions should not be exaggerated, however. The continuing high cost of launching anything into space will certainly force designers to optimize space vehicles for their specific non-weapon missions, and the results is not likely to be a very agile or capable ASAT. The Soviet's Prognoz resupply vehicle, for instance, is obviously designed to deliver the maximum amount of provisions in few trips. Its takeoff weight, fully loaded, is perhaps three times that of the Soviet's own bulky ASAT, and consequently it uses an enormous booster just to reach altitudes of a few hundred miles. Such jury-rigged ASATs are not very good foundations for a weapon system to "sweep the skies," and making vital U.S. satellite functions survivable against such residual threats should be manageable.

Nevertheless, an ASAT arms control agreement could incorporate collateral constraints on the characteristics and use of non-weapon space technologies. These constraints might include, for instance, limits upon speed of approach in rendezvous maneuvers, or upon power/aperture characteristics of lasers in space. However, it would be premature to propose a long list of such constraints right now, to govern future cases of space technology. The treaty proposed here would accommodate such collateral constraints in several ways. Cases which the parties find of immediate concern could be addressed in treaty negotiations and incorporated as additional articles, or perhaps as cooperative measures in test or space-use procedures that aid verification. Limits on future cases involving new technologies would best be addressed on a case-by-case basis in the Standing Consultative Commission, as the specific dimensions of problems and remedies become clear. This approach would raise our confidence that such space vehicles were not being readied as ASATs, while minimizing the impact upon non-weapon space exploration.

A final verification concern is that of "breakout," that is, the possibility that the Soviet Union could assemble a significant ASAT capability by abruptly abrogating the treaty through running a quick set of space tests. At issue here is how close to operational status an ASAT weapon could be brought, if assembled and tested only on the ground or covertly in space as dismantled components (e.g., testing homing sensors for ASAT interceptors on some ostensibly non-weapon space mission). Inconsistencies occasionally crop up in arguments on this matter. On the one hand, it is claimed the Soviets could readily concoct an ASAT system even though space tests were banned; on the other, it is asserted the United States could not accept a ban on testing because then it would be unable to confirm that its own ASAT system works. A more balanced viewpoint is in order here.

The United States has already conducted enough engineering tests of its own ASAT interceptor to be ready for immediate space tests, so even if a moratorium on tests were agreed upon now, the United States would not be without experience. If the ASAT accord banned tests but allowed both sides to keep their present ASAT weapons, then clearly both would have some "breakout" potential.

Though the existing Soviet ASAT is a much more tractable problem than what unrestrained ASAT competition would bring, this "breakout" potential would be of some concern for the United States. A combination of reasonable survivability measures, eroding Soviet confidence in their ASAT in the absence of tests, and further negotiations leading toward complete dismantling of ASATs would address our concerns.

"Breakout" using an entirely new ASAT weapon that had been tested only on the ground or covertly—component by component—in space would be quite risky, technically and politically. In ASAT weapons as in modern weaponry in general, capability and complexity are linked—the more capable a weapon is in coping with a variety of combat requirements, the more complicated it is likely to be, and the more in need of tests that simulate actual engagements. Soviet attempts to conduct realistic full-system ASAT tests in space covertly would confront the whole battery of U.S. intelligence sensors. On the other hand, breaking the ASAT system down into component parts for covert testing, in order to minimize the chance of detection, entails a risk that the whole system will not work as well operationally as the parts. The Soviets have clearly experienced gaps between plans and performance in space and weapon systems, and even catastrophic shortcomings. Without tests, the Soviets could not confidently predict how soon a new device could be made to work after "breakout"—if at all. An ASAT test ban could serve U.S. interests by exploiting Soviet uncertainties and fear of detection, while leaving the United States free to complicate the Soviet's "breakout" task through a variety of satellite defensive measures.

In sum, there are no obvious reasons why an arms control agreement banning space tests and use of ASAT weapons could not be adequately verifiable. There may be some areas of uncertainty, but not so great as to permit the Soviets to pose a significant unanticipated threat to U.S. security if we take prudent steps toward improving intelligence capabilities and diversifying and protecting vital satellite functions.

VI. Comparison with the 1981 Soviet draft treaty

There are several important contrasts between the treaty proposed here and the provisions of the Soviet Union's draft treaty placed before the United Nations.

The first contrast is in comprehensiveness. Article 1 of the Soviet treaty addresses weapons placed in orbit around the earth. Strictly speaking, the Soviet formulation does not appear to limit further tests and development of either the Soviet or U.S. ASAT systems. In space tests, the current Soviet interceptor goes into orbit before attacking its target, but it may well be able to attack satellites by direct ascent or after partial orbit. The U.S. ASAT is a direct-ascent interceptor that does not go into orbit. Hence, both seem to elude a ban on weapons "placed in orbit." Ground-based laser ASATs also elude the Soviet formulation. In contrast, the treaty proposed here prohibits all testing of ASAT weapons in space or against objects in space, whether the ASAT weapon is ground- or space-based. This includes tests against one's own space objects, not (as the Soviet text reads) just those of other parties.

In a second contrast, Article 1 of the Soviet draft treaty reads, in part, "the parties undertake not to station such weapons in outer space . . . including on reusable manned space vehicles." Because the U.S. Space Shuttle is the only such vehicle now in use, such specific mention in the Soviet proposal must raise suspicions that the Soviets intend to somehow impair the Shuttle program. This impression was compounded by the fact that the English text of the treaty used by some nations in the United Nations left out the crucial word "on." The draft was therefore understood to include "reusable manned vehicles" among the weapons banned from space. Specific mention of reusable manned vehicles is in fact superfluous and is dropped from our proposed treaty text. Any general obligation not to test or place anti-satellite weapons in space would apply, no matter what launch vehicle happened to be used. The Soviets would be banned from using their current space vehicles, such as Salyut or Prognoz, or any future Soviet shuttle, for such purposes. The same constraints would of course apply to the U.S. Space Shuttle.

In a third contrast, Article 3 of the Soviet draft treaty contains a general ban on the use of weapons in outer space. The Soviet version, however, adds a reservation: the satellites of the other side would enjoy protection if they did not violate other restraints in the treaty. Here, and in Article 2 as well, the Soviet

draft seems to attempt a general limitation on satellites, rather than upon anti-satellite weapons. Indeed, the Soviet formulation gives an impression of legitimizing attacks upon satellites engaged in certain acts, rather than forbidding, such attacks.

There are two underlying issues here: first, what rights would one side retain, if the other tested or used an anti-satellite weapon in violation of the treaty; and second, what would the sides be permitted if a third nation tested or used an ASAT weapon in space? On the first point, obviously any violation of ASAT limits by the United States or the Soviet Union would be a grave act, and the other side would be justified in exercising rights of withdrawal from the treaty. Such provisions for withdrawal, customary in previous arms control treaties, are adequate to cope with this issue, when buttressed by prudent satellite survivability measures.

The second point underscores the importance of eventually transforming a bilateral ASAT treaty into a multilateral accord. It would be regrettable indeed if some third nation undercut superpower limitations upon space arms competition by launching its own ASAT. Still, a bilateral ASAT treaty between the superpowers upon the space objects of third nations. If third parties disrupt the agreement reached by the superpowers, the first recourse for the United States and Soviet Union should be consultation as provided for in the attached treaty. The final recourse would be inherent right of withdrawal where extraordinary events jeopardize supreme national interests.

Finally, the introduction of the Soviet draft proposal in the U.N. General Assembly raises the question of whether the best prospect for space arms control is through multilateral or bilateral negotiations. A superpower arms competition in space would certainly be a matter of global concern. Objects circling the earth in outer space can come within a hundred miles or so of every point on the globe, of every nation on earth. Outer space can be used in a host of ways to yield security and prosperity for all nations. It is therefore desirable that any arms control restraints on weapons in outer space be broadly affirmed and respected by all nations.

However, at the moment only the Soviet Union and the United States have ASAT programs. Since their accession is indispensable to any meaningful limitations on space weapons, and since their ASAT programs are proceeding apace, it is most important that the superpowers begin direct negotiations, unimpeded by the delays that unavoidably arise in wider multilateral forums.

The best course would therefore be for the United States and the Soviet Union to begin direct negotiations on bilateral restraints, keeping in mind the desirability of eventually incorporating their accord into a multilateral treaty appropriate for signature by all nations.

APPENDIX

A TREATY LIMITING ANTI-SATELLITE WEAPONS

PREAMBLE

Article I

Each Party undertakes not to destroy, damage, render inoperable or change the flight trajectory of space objects of other States.

Article II

1. Each Party undertakes not to place in orbit around the earth weapons for destroying, damaging, rendering inoperable, or changing the flight trajectory of space objects, or for damaging objects in the atmosphere or on the ground.

2. Each Party undertakes not to install such weapons on celestial bodies, or station such weapons in outer space in any other manner.

3. Each Party undertakes not to test such weapons in space or against space objects.

Article III

1. For the purpose of providing assurance of compliance with the provisions of this treaty, each Party shall use national technical means of verification at its disposal in a manner consistent with generally recognized principles of international law.

2. Verification by national technical means shall be supplemented, as appropriate, by such cooperative measures for contributing to the effectiveness of verification by national technical means as the Parties shall agree upon in the Standing Consultative Commission.

3. Each Party undertakes not to interfere with the national technical means of verification of the other Party operating in accordance with paragraph 1 of this Article.

4. Each Party undertakes not to use deliberate concealment measures which impede verification by national technical means of compliance with this treaty.

Article IV

1. To promote the objectives and implementation of the provisions of this treaty, the Parties shall use the Standing Consultative Commission, established by the Memorandum of Understanding Between the Government of the United States of America and the Government of the Union of Soviet Socialist Republics regarding the Establishment of a Standing Consultative Commission of December 21, 1972.

2. Within the framework of the Standing Consultative Commission, with respect to this treaty, the Parties will:

(a) consider questions concerning compliance with the obligations assumed and related situations which may be considered ambiguous;

(b) provide on a voluntary basis such information as either Party considers necessary to assure confidence in compliance with the obligations assumed;

(c) consider questions involving unintended interference with national technical means of verification, and questions involving unintended impeding of verification by national technical means of compliance with the provisions of this treaty;

(d) consider, as appropriate, cooperative measures contributing to the effectiveness of verification by national technical means;

(e) consider possible changes in the strategic situation which have a bearing on the provisions of this treaty, including the activities of other States;

(f) consider, as appropriate, possible proposals for further increasing the viability of this treaty, including proposals for amendments in accordance with the provisions of this treaty.

Article V

The Parties undertake to begin, promptly after the entry into force of this treaty, active negotiations with the objective of achieving, as soon as possible, agreement on further measures for the limitation and reduction of weapons subject to limitation in Article II of this treaty.

Article VI

In order to ensure the viability and effectiveness of this treaty, each Party undertakes not to circumvent the provisions of this treaty, through any other State or States, in any other manner.

Article VII

Each party undertakes not to assume any international obligation which would conflict with this treaty.

Article VIII

1. Each Party may propose amendments to this treaty.

2. Agreed amendments shall enter into force in accordance with the procedures governing the entry into force of this treaty.

Article IX

This treaty shall be of unlimited duration.

Article X

Each Party shall, in exercising its national sovereignty, have the right to withdraw from this treaty if it decides that extraordinary events related to the subject matter of this treaty have jeopardized its supreme interests. It shall give notice of its decisions to the other Party six months prior to withdrawal from the treaty. Such notice shall include a statement of the extraordinary events the notifying Party regards as having jeopardized its supreme interests.

Article XI

1. This treaty shall be subject to ratification in accordance with the constitutional procedures of each Party.

2. This treaty shall enter into force on the day of the exchange of instruments of ratification.

Article XII

1. Done in two copies, each in the English and Russian language, both texts being equally authentic.

2. This treaty shall be registered pursuant to Article 102 of the Charter of the United Nations.

Senator PRESSLER. Thank you very much.

Dr. Garwin.

[Mr. Garwin's biographical data follows:]

BIOGRAPHICAL DATA OF RICHARD L. GARWIN

Richard L. Garwin was born in Cleveland, Ohio, in 1928. He received the B.S. in Physics from Case Institute of Technology, Cleveland, in 1947, and the Ph. D. in Physics from the University of Chicago in 1949.

After 3 years on the faculty of the University of Chicago, he joined IBM Corporation in 1952, and is at present IBM Fellow at the Thomas J. Watson Research Center, Yorktown Heights, New York; Adjunct Research Fellow in the Kennedy School of Government, Harvard University; Andrew D. White Professor-at-Large, Cornell University; and Adjunct Professor of Physics at Columbia University. In addition, he is a consultant to the U.S. Government on matters of military technology, arms control, etc. He has been Director of the IBM Watson Laboratory, Director of Applied Research at the IBM Thomas J. Watson Research Center, and a member of the IBM Corporate Technical Committee. He has also been Professor of Public Policy in the Kennedy School of Government, Harvard University.

He has made contributions in the design of nuclear weapons, in instruments and electronics for research in nuclear and low-temperature physics, in the establishment of the nonconservation of parity and the demonstration of some of its striking consequences, in computer elements and systems including superconducting devices, in communication systems, in the behavior of solid helium, in the detection of gravitational radiation, and in military technology. He has published about 100 papers and been granted 27 U.S. Patents. He has testified to many Congressional committees on matter involving national security, transportation, energy policy and technology, and the like. He is coauthor of the books *Nuclear Weapons and World Politics* (1977), *Nuclear Power Issues and Choices* (1977), *Energy: The Next Twenty Years* (1979), and *Science Advice to the President* (1980).

He was a member of the President's Science Advisory Committee 1962-65 and 1969-72, and of the Defense Science Board 1966-69. He is a Fellow of the American Physical Society and of the American Academy of Arts and Sciences; and a member of the National Academy of Sciences, the Institute of Medicine, the National Academy of Engineering, the Council on Foreign Relations, and the American Philosophical Society. The citation accompanying his 1978 election to the U.S. National Academy of Engineering reads "Contributions applying the latest scientific discoveries to innovative practical engineering applications contributing to national security and economic growth." He was awarded the 1983 Wright Prize for interdisciplinary scientific achievement.

He is a member of the Council of the Institute for Strategic Studies (London), and during 1978 was Chairman of the Panel on Public Affairs of the American Physical Society.

His work for the government has included studies on antisubmarine warfare, new technologies in health care, sensor systems, military and civil aircraft, and satellite and strategic systems, from the point of view of improving such systems as well as assessing existing capabilities.

STATEMENT OF RICHARD L. GARWIN, IBM THOMAS J. WATSON RESEARCH CENTER; ADJUNCT PROFESSOR OF PHYSICS, COLUMBIA UNIVERSITY; ANDREW D. WHITE, PROFESSOR-AT-LARGE, CORNELL UNIVERSITY; ADJUNCT RESEARCH FELLOW, KENNEDY SCHOOL OF GOVERNMENT, HARVARD UNIVERSITY, YORKTOWN HEIGHTS, N.Y.

Mr. GARWIN. These are, of course, my own views. I testified September 20 to this committee urging the Government to conclude with the Soviet Union an agreement effectively banning testing of antisatellite weapons, and banning the deployment of weapons in space. Mr. Adelman just spoke vehemently of the desirability of effectively banning such threats to satellites, and so I gather it is just a matter of details over how we proceed.

A bilateral ASAT treaty drafted with the goal of becoming an international agreement should have no difficulty in gaining wide support after it entered into force between the United States and the Soviet Union, so regardless of discussions in the Committee on Disarmament I believe our national interest will be served best by entering as soon as possible into serious negotiations with the Soviet Union.

A close reading of the draft treaty provided you shows, of course, that it forbids actual attack on satellites of other states, and that is article I. That in itself would be little comfort to us, like a renunciation of the use of force, abjuring attack on satellites without limiting testing and readiness and without maintaining vigilance about the potential threat would hardly add to our security. But this article I motivates the rest of the draft.

The real teeth and protection of the draft reside in article II, banning the placing of ASAT weapons in orbit and banning the testing of such weapons in space or against space objects. This would ban any further testing of the Soviet ASAT, which has apparently been tested in only a very limited range of orbital inclinations and with only about a 50 percent success rate.

It would also ban space tests of the U.S. miniature homing vehicle, the key element of the F-15 aircraft-launched ASAT now nearing test phase. Furthermore, it would ban tests of ground-based lasers against satellites as well as ban the testing of space-based lasers which otherwise might be claimed to be ASAT oriented but which were in fact a Soviet program which might evolve to BMD [ballistic missile defense] capability.

I have to condense and I would like your approval of placing into the record my full opening statement and the backup material and, in addition, letters which I have published in the New York Times on March 30, 1983, and this very day, May 18.

Senator PRESSLER. Without objection.

Mr. GARWIN. Thank you.

Verification by national technical means in our draft would, of course, include the use of existing radars, optical telescopes, satellite sensors and the like with which the U.S. monitors compliance with existing arms control agreements. It would become worthwhile also to make specialized observation systems to determine whether Soviet satellites were being heated by ground-based lasers, to provide close-in photographs of maneuverable space objects and the like.

In general, it is much easier to detect a violation of such a treaty than to determine which of an enormous array of permitted activities in the absence of a treaty are a threat to U.S. security. But, as Senator Tsongas noted, it would be difficult to verify that F-15s are not equipped with banned ASATs and, as Mr. Adelman indicated, we do not need arms control if it is only going to be a cause for serious strife between our nations.

That is why one needs to limit one's desires in the scope of a treaty to what can be reasonably verified, and that is why our draft treaty bans testing of ASAT and other space weapons and does not undertake to ban possession.

Then I describe the Soviet ASAT program mounted on an SS-9-like—

Senator TSONGAS. Could I interrupt for just a moment?

[Pause.]

Senator TSONGAS. Thank you.

Mr. GARWIN. And I describe our own. But I emphasize the urgency of stopping the evolution of ASAT systems. On February 24 of this year, Prof. Carl Sagan and I prepared a petition for a ban on space weaponry which is among the backup material. More than 40 space scientists, physicists and others have joined us in urging the United States, the Soviet Union, and other space-faring nations—this is a direct quote—"to negotiate for their benefit and for the benefit of the human species a treaty to ban weapons of any kind from space and to prohibit damage to or destruction of satellites of any nation."

In this petition, we noted specifically the continuing tests of the Soviet ASAT and the imminent test of the U.S. system. We cabled the petition March 26 to the leaders of France, India, Japan, the People's Republic of China, the Soviet Union, the United Kingdom and the United States.

Now in no way can we negotiate for the U.S. Government, but we would be remiss if we did not use our experience and our knowledge to provide our best judgment to the leaders of the world who are capable of action to reduce the threat of conflict in space. We have received one reply, included with the backup material, and I include also our reply to Secretary Andropov, reminding him:

Your reply mentions American plans and pronouncements on American anti-satellite weapons but says nothing about the existing Soviet antisatellite capabilities.

We believe that significant steps toward a practical and equitable treaty banning space weaponry would be greatly aided if the U.S.S.R. would publicly state that as part of a comprehensive treaty banning space weaponry it would be willing to forego tests of any antisatellite system it may have developed or deployed, provided the United States made an identical commitment.

Our defenses and backup systems are important, although if we ban all further testing of the Soviet ASAT and any space testing of our own system, it would be many months before either side had an effective system after denouncing the treaty.

The defense of satellites against ASATs is going to be extremely difficult. Maneuver, hardening—some things can be done there—parasols against ground-based lasers, mostly, though, backups which I have sketched in some detail for supplementing our satellite capabilities in case of theater war in Europe will render destruction of our satellites useless. We can have the same capability in a limited theater

for weather, radar, photo reconnaissance, navigation and so on at a high cost—if we had to pay it every day for decades—but at a very affordable cost, day-by-day, in comparison with a large-scale war.

Space defense against nuclear weapons, which has come up in this meeting—my views are on the record of a Senate Armed Services meeting of May 2, and here I should just ask that that be placed in the record, and I want to note the judgment by Edward Teller, testifying at that same hearing, that ballistic missile defense systems based on satellites would cost vastly more than the system which could defeat them.

That does not mean that Teller agrees with me that we are taking the wrong approach in emphasizing now defense before we understand how to do it, or that the Secretary of Defense has a warranted position when he explained on national television March 27 that he is confident that we can have an essentially perfect defense against nuclear ballistic missiles and against nuclear-armed cruise missiles as well. That goes far beyond the President's speech and far beyond, I think, what Professor Teller would say.

So my views on the utility of space defense are negative, and I certainly do not think that the hopes for such space defense—supposed to be undertaken anyhow in conformance with the ABM Treaty obligations—I do not believe that those opportunities, so-called, should stand in the way of an urgent negotiation to ban antisatellite activities and to protect our satellites for military and civil uses.

Thank you.

[Mr. Garwin's prepared statement follows:]

PREPARED STATEMENT OF RICHARD L. GARWIN

Thank you for the invitation to present my views in support of the improved national security to be obtained by limitations on the possible threat to our satellite systems, so important now to our society, to our conventional military capability, and especially to our confidence in understanding the world and in avoiding developments which might lead to nuclear war.

I testified to this Committee September 20, 1982, urging the U.S. Government to conclude with the Soviet Union an agreement effectively banning testing of anti-satellite weapons, and banning the deployment of weapons in space. It is important to limit the evolution of Soviet antisatellite capability, and continued use of U.S. satellites in peace and in war is much more important to the United States than the freedom to test our own ASAT system. A bilateral ASAT treaty drafted with the goal of becoming an international agreement should have no difficulty in gaining wide support, after it entered into force between the United States and the Soviet Union. At that hearing I indicated that it would be useful for even a private group to consider an appropriate text, and I am grateful to the Union of Concerned Scientists for providing the text which has been presented by Dr. Gottfried, and which I support.

Since the 1950's, I have been involved in military and civil space activities, as well as with the evolution of our ICBM and SLBM forces, with the R&D program on ballistic-missile defense (BMD), and with the assessment of the balance between the United States and the Soviet Union. I have participated, on behalf of the U.S. Government, in international negotiations to prevent surprise attack, to limit the testing of nuclear weapons, and I have studied such matters for many years for the Department of Defense, for the White House, and for other government agencies.

A close reading of this draft treaty shows, of course, that it forbids actual attack on satellites of other states (Article I). That in itself would be little comfort to us; like a renunciation of the use of force, abjuring attack on satellites without limiting testing and readiness and without maintaining vigilance about the potential threat would hardly add to our security. But this Article I motivates the rest of the Draft.

The real teeth and protection of the Draft reside in Article II, banning the placing of ASAT weapons in orbit (II.1), and banning the testing of such weapons in space or against space objects. This would ban any further test of the Soviet ASAT, which has apparently been tested in only a very limited range of orbital inclinations, and which is said to have had only about 50 percent success rate. It would also ban space tests of the U.S. MHV (miniature homing vehicle)—the key element of the F-15 aircraft-launched ASAT now nearing test phase. Furthermore, it would ban tests of ground-based lasers against satellites, as well as the testing of space-based lasers which otherwise might be claimed to be ASAT-oriented but which were in fact a Soviet program which might evolve to BMD capability.

The ban on stationing weapons in orbit would effectively bar the emplacement of space mines—small satellites carrying conventional explosives (like a Claymore mine), which from a modest distance of a kilometer or less could be commanded instantly to destroy the satellite it had accompanied for weeks or months. No existing agreement bans the emplacement of space mines, and that is a critical threat to the survival of U.S. satellite systems in conventional war or at the outbreak of nuclear war.

Verification by national technical means (NTM) would, of course, include the use of existing radars, optical telescopes, satellite sensors, and the like, with which the United States monitors compliance with existing arms control agreements. It would become worthwhile also to make specialized observation systems to determine whether Soviet satellites were being heated by ground-based lasers, to provide close-in photographs of maneuverable space objects, and the like. In general, it is much easier to detect a violation of such a treaty than to determine which of an enormous array of permitted activities (in the absence of a treaty) are a threat to U.S. security.

ASAT STATUS

The December 1982 Committee Print, "Soviet Space Programs: 1976-80," describes the Soviet ASAT as weighing some 3,300 kg, and being launched by an "F-1-m" rocket assembly from Tyuratam into orbits of inclinations varying from 62 to 65 degrees, or so. The F-1 is said to be derived from the SS-9, the monster predecessor of the current SS-18 ICBM. The Print lists 17 tests of the Soviet ASAT, with indifferent success reported. To extend the altitude range of a co-orbital interceptor from low earth orbit to circular synchronous orbit requires almost 4 km/s additional velocity, and that would require an additional stage of propulsion about five times as large as the entire F-1 booster.

The U.S. ASAT program will use an MHV propelled by the booster from the Short-Range Attack Missile (SRAM), on which is mounted an Altair rocket. The system is designed for intercept of satellites in low earth orbit, not by going into orbit and making small adjustments to attack the quarry, but by "direct ascent," a far more difficult approach requiring extreme accuracy in position and time. This approach, however, allows destruction of a satellite with MHV lobbed to orbital altitude, without requiring orbital velocity—a saving of about a factor 3 in launch weight (on top of the factor 100 which arises because the MHV is so much smaller than the Soviet ASAT vehicle). The F-15 fighter aircraft and the earth's rotation add another 1.4 km/s.

The F-15 ASAT, technically, will be able to operate from any ordinary airfield, given adequate command and control, so that satellite intercepts in LEO could take place, in principle, within an hour of the command to perform them. The Soviet ASAT, thus far launched only from a single complex, would have to wait until the earth turned to bring the launch site under the satellite orbit—as much as 24 hours. Upgrade to attack satellites at geosynchronous altitude (GEO) would require a very large booster to carry the Soviet ASAT, while a 16,000-lb system, still carried on the F-15, would handle the MHV approach. To stop testing right now will leave the United States closer to an effective all-altitude ASAT capable of attacking large numbers of satellites than it will leave the Soviets; but it will leave both sides comfortable that months must elapse after an abrogation of the treaty before such an effective capability can exist.

I emphasize the urgency of stopping the evolution of ASAT systems. On February 24 of this year, Professor Carl Sagan and I prepared a "Petition For A Ban On Space Weaponry," which I hope can be introduced into the record. More than 40 physicists, space scientists, and strategists have joined us "... in urging the United States, the Soviet Union and other spacefaring nations to

negotiate, for their benefit and for the benefit of the human species, a treaty to ban weapons of any kind from space, and to prohibit damage to or destruction of satellites of any nation." We cabled the petition March 28 to the leaders of France, India, Japan, the Peoples Republic of China, the Soviet Union, the United Kingdom, and the United States. In the petition we noted specifically the continuing tests of the Soviet ASAT, and the imminent test of the U.S. system. In no way can we negotiate for the U.S. Government, but we would be remiss if we did not use our experience and our knowledge to provide our best judgment to the leaders of the world who are capable of action to reduce the threat of conflict in space.

We have received only one response thus far, from Secretary Andropov, which I append. We have responded, emphasizing that "significant steps towards a practical and equitable treaty banning space weaponry would be greatly aided if the U.S.S.R. would publicly state that, as part of a comprehensive treaty banning space weaponry, it would be willing to forego tests of any anti-satellite system it may have developed or deployed, provided the United States made an identical commitment."

Senator Pressler and colleagues, we can urgently negotiate a treaty along the lines of the Draft presented here, or we can see the wealth and security of our nation imperiled by a needless, conflict in space, brought about by a greater desire for advantage than for mutual benefit, and fostered by emerging doctrine and organizations which regard space as an opportunity for conflict rather than the marvelous tool and environment which it is. We can try to make space safe for all non-weapon activities, or we can risk our own continued military and civil use of space. Negotiation, without further ASAT tests, is an opportunity we will not have much longer.

[Attachments]

CORNELL UNIVERSITY,
CENTER FOR RADIOPHYSICS AND SPACE RESEARCH.
Ithaca, N.Y., May 16, 1983.

Secretary-General Y. V. ANDROPOV,
Moscow

DEAR SECRETARY ANDROPOV, We appreciate your reply to the petition of February 24 1983 to ban space weaponry, signed now by forty prominent American defense strategists and space scientists. It was sent to the leaders of all space-faring nations with an independent launch capability. The Soviet Union was the first nation to reply. We are confident that large numbers of our Soviet colleagues are as concerned as we are about the imminent and potentially irreversible extension of earthly military confrontation into the space environment.

No one nation is solely responsible for the global crisis that we face. In our petition to you and the other heads of spacefaring nations, we noted Soviet tests of anti-satellite weapons since the early 1970's, as well as the U.S. anti-satellite system now approaching its test phase. Your reply mentions American plans and pronouncements on American anti-satellite weapons, but says nothing about the existing Soviet anti-satellite capability. We believe that significant steps towards a practical and equitable treaty banning space weaponry would be greatly aided if the U.S.S.R. would publicly state that, as part of a comprehensive treaty banning space weaponry, it would be willing to forego tests of any anti-satellite systems it may have developed or deployed, provided the United States made an identical commitment.

Sincerely,

RICHARD L. GARWIN.
CARL SAGAN.

[Appended is an up-to-date list of leading American defense strategists and space scientists who have signed the petition.]

Y. V. ANDROPOV'S RESPONSE TO THE APPEAL OF A GROUP OF AMERICAN SCIENTISTS
AND PUBLIC FIGURES, APRIL 25, 1983

Dear Sirs. Your appeal regarding the prohibition of space weapons is permeated with serious concern about the peaceful future of space. I fully share this concern. Preventing the militarization of outer space is one of the priority problems facing mankind, and a lot depends here, on Earth, on whether or not it will be resolved.

As scientists and experts you realize well enough the extremely dangerous consequences of saturating outer space with deadly weapons. Statesmen, poli-

ticians and scientists should really do everything possible already now not to have the achievements of human mind and the accelerated progress of science and technology used to the detriment of people.

I would like to emphasize that it is precisely the Soviet Union—the country which 25 years ago opened the path into space—that is the initiator of and participant in all the currently existing international agreements aimed at having space used only for peaceful purposes, to the benefit of mankind.

In order to resolve this task radically the Soviet Union, as, I believe, you know, has proposed that a treaty be concluded prohibiting the placement in outer space of weapons of any kind. We submitted such draft treaty to the United Nations as early as August 1981. The implementation of that Soviet proposal, in support of which the overwhelming majority of the U.N. member-states cast their votes, would be tantamount to setting a reliable barrier to the attempts to turn space into a source of a deadly danger to people.

Unfortunately, the work on the draft of such a treaty in the Committee on Disarmament, in fact, has not yet begun because of the position of the USA and a number of other NATO countries. Moreover, the recent developments show that in the strategic calculations of the USA, including those declared at the level of the highest American leadership, an ever increasing role is assigned to the use of military space hardware.

Now a truly decisive moment is coming: either the interested states will without delay sit at the negotiating table and take up the preparation of a treaty prohibiting the placement in outer space of weapons of any kind or the arms race will spread into space as well.

I can assure you that the Soviet Union will continue to apply the maximum of efforts to prevent the sinister plans of carrying over the arms race into space from turning into reality.

I would like to hope that the scientists and public figures of the entire world will also make their contribution to space remaining forever free of any weapons, to preventing it from becoming an arena of military clashes, to assuring that there will be no threat from space to those living on Earth.

I wish you success in your efforts to protect peaceful space, the efforts which are fully supported in the Soviet Union.

Sincerely,

Y. ANDROPOV.

PETITION FOR A BAN ON SPACE WEAPONRY, FEBRUARY 24, 1983

In the quarter century since the first artificial Earth satellite was launched, on October 4, 1957, humans have used their new spacefaring capability wisely—for global communications; navigation; weather observations; monitoring Earth resources; for reconnaissance, which tends to moderate destabilizing world political and military trends; and for verifying the compliance of nations with their treaty obligations. The exploration of space by men and women, and particularly the scientific results of planetary missions and observations from space platforms, have changed our view of the universe. They have made it possible for us to understand our environment in ways which may be critical in the solution of major world problems. These developments have been almost wholly benign, have significantly benefited the peoples of the Earth, and represent an important aperture to a hopeful future for the human species.

After American nuclear explosions in space inadvertently damaged satellites of the United States and other nations in 1962, most countries of the world, including the United States, and the Soviet Union, agreed in the Limited Test Ban Treaty of 1963 never to explode nuclear weapons in space, in the oceans, or in the atmosphere. In 20 years no signatory nation has violated this agreement. Most nations, including the United States and the Soviet Union, also adhere to the Outer Space Treaty of 1967 banning from space all weapons of mass destruction, and, specifically, all nuclear weapons. But fiction writers and military strategists have for about a century romanticized the purported inevitability of warfare in space. The use of non-nuclear weapons of more limited lethality than "mass destruction," while forbidden on other celestial bodies by the 1967 Treaty, is still permitted in Earth orbit, and in cislunar, circumplanetary and interplanetary space.

We believe that the testing or deployment of any weapons in space—in part by threatening vital satellite assets—significantly increases the likelihood of warfare on Earth. The Soviet Union has tested a rudimentary anti-satellite

weapons system beginning in the early 1970's, but in 1981 formally presented a draft treaty banning all space weapons and prohibiting damage to or destruction of satellites by any means. The United States will soon begin testing a much more sophisticated anti-satellite system. Once such weapons systems are established in national arsenals they become very difficult to displace. Proposals, for example, to ban MIRVs before their deployment were rejected; today these destabilizing weapons systems are generally distributed and threaten the security of all nations. Failure to limit their deployment is now widely regretted. If space weapons are ever to be banned, this may be close to the last moment in which it can be done.

RICHARD L. GARWIN.
CARL SAGAN.

We join in urging the United States, the Soviet Union and other spacefaring nations to negotiate, for their benefit and for the benefit of the human species, a treaty to ban weapons of any kind from space, and to prohibit damage to or destruction of satellites of any nation.

Richard L. Garwin, IBM Thomas J. Watson Research Center, P.O. Box 218, Yorktown Heights, N.Y.

Carl Sagan, Professor of Astronomy and Space Sciences and Director, Laboratory for Planetary Studies, Cornell University, Ithaca, N.Y.

Hans A. Bethe, Professor of Physics Emeritus, Cornell University; Nobel Laureate in Physics; Head, Theoretical Division, Manhattan Project; Consultant, Los Alamos Scientific Laboratory.

E. Margaret Burbidge, Professor of Astronomy and Director, Center for Astrophysics and Space Sciences, University of California at San Diego; President, American Association for the Advancement of Science.

Clark R. Chapman, Senior Scientist, Planetary Science Institute, Science Applications Inc., Tucson; Chairman, Division for Planetary Sciences, American Astronomical Society.

Thomas M. Donahue, Professor of Atmospheric Science, University of Michigan; Chairman, Space Science Board, National Academy of Science/National Research Council.

Sidney D. Drell, Professor of Physics, Stanford University; Consultant to the Senate Select Committee on Intelligence and to the National Security Council.

Lee A. DuBridge, President Emeritus, California Institute of Technology; Science Adviser to former President Nixon.

Admiral Noel Gayler (USN, Ret.), former Director, National Security Agency; former Commander-in-Chief, U.S. Forces in the Pacific; former Deputy Chief of Naval Operations (Research and Development).

Donald M. Hunten, Professor of Planetary Sciences, University of Arizona.

Christopher C. Kraft, former Director, Flight Operations, Apollo missions to the Moon; former Director, NASA Johnson Space Center.

Vice-Admiral John Marshall Lee (USN, Ret.), former Assistant Director, U.S. Arms Control and Disarmament Agency.

Franklin A. Long, Professor of Chemistry Emeritus, Cornell University; former Associate Director, U.S. Arms Control and Disarmament Agency.

Carson Mark, former Head, Theoretical Division, Los Alamos Scientific Laboratory.

James S. Martin, Jr., former Vice President and General Manager, Martin Marietta Corporation; Project Manager, Viking mission to Mars, NASA.

David Morrison, Professor of Astronomy, University of Hawaii.

Philip Morrison, Group Leader, Manhattan Project; Professor of Physics, Massachusetts Institute of Technology.

Bruce C. Murray, Professor of Planetary Sciences, California Institute of Technology; former Director, Jet Propulsion Laboratory, NASA.

Gerry Neugebauer, Professor of Physics, California Institute of Technology; Director, Mount Palomar Observatory.

Tobias Owen, Professor of Astronomy and Chairman, Astrophysics Program, State University of New York at Stony Brook.

Wolfgang K. H. Panofsky, Director, Stanford Linear Accelerator Center; former member, General Advisory Committee, U.S. Arms Control and Disarmament Agency.

Gordon H. Pettengill, Professor of Planetary Physics, Massachusetts Institute of Technology.

William Pickering, Professor of Electrical Engineering Emeritus, California Institute of Technology; former Director, Jet Propulsion Laboratory, NASA.

Edward M. Purcell, Professor of Physics Emeritus, Harvard University; Nobel Laureate in Physics.

J. I. Rabi, Professor of Physics Emeritus, Columbia University; Nobel Laureate in Physics.

George W. Rathjens, Professor of Political Science, Massachusetts Institute of Technology; former Chief Scientist, Advanced Research Projects Agency, Department of Defense.

Glenn T. Seaborg, Professor of Chemistry, University of California at Berkeley; former Chairman, Atomic Energy Commission; Nobel Laureate in Chemistry.

Eugene M. Shoemaker, Research Geologist, United States Geological Survey; Professor of Geology and Planetary Science, California Institute of Technology.

John A. Simpson, Professor of Physics, Enrico Fermi Institute, University of Chicago; Chairman, Steering Committee, Space Science Working Group, Association of American Universities.

Edward C. Stone, Professor of Physics, California Institute of Technology; Chief Project Scientist, Voyager mission to the outer solar system, NASA.

James Van Allen, Professor of Physics, University of Iowa; President, American Geophysical Union.

Victor F. Weisskopf, Professor of Physics Emeritus, Massachusetts Institute of Technology; former Director, European Center for Nuclear Research; Member, Pontifical Academy of Sciences, Rome.

Jerome B. Wiesner, President Emeritus, Massachusetts Institute of Technology; Science Advisor to former Presidents Kennedy and Johnson.

Robert R. Wilson, Professor of Physics, Columbia University; Head, Research Division, Manhattan Project; former Director, Fermi National Accelerator Laboratory; President, American Physical Society.

Herbert F. York, Professor of Physics, University of California at San Diego; former Chief Scientist, Advanced Research Projects Agency, Department of Defense.

[The preceding is a partial list of signatories. Affiliations are for identification purposes only as of May 16, 1983.]

[From the New York Times, Mar. 30, 1983]

REAGAN'S RISKINESS

(By Richard L. Garwin)

YORKTOWN HEIGHTS, N.Y.—President Reagan startled the world when he called on the "scientific community in our country, those who gave us nuclear weapons," to provide a means of rendering "nuclear weapons impotent and obsolete." As one of those scientists, I do not share Mr. Reagan's optimism.

In 1981, Edward Teller characterized my contribution to the first hydrogen bomb, exploded November 1952, this way: "In the end, the shot was fired almost precisely according to Garwin's design, and it worked as expected." Unlike nature, which does not cunningly place roadblocks in the way of invention, the Soviet Union will exploit every opportunity to blind, render dumb, decoy or attack proposed defenses that threaten to disarm it. Of almost 10,000 Soviet strategic nuclear warheads, only a few dozen or a hundred need penetrate our defenses to destroy our nation. A defense requires a system of unprecedented effectiveness.

The United States has long studied the prospects for destroying intercontinental ballistic missiles and submarine launched ballistic missiles as they re-enter the atmosphere or as they travel above the atmosphere. But prospects continue to be dim for defense against nuclear weapons at these stages because defense itself is vulnerable and because it is easy to provide many look-alikes (decoys) for warheads in space. Destroying missiles early in their flight is more attractive. Compared with the problem posed by defending against multiple warheads, the missiles themselves in the boost-phase are fewer, more fragile and much more visible because of the large rocket flame. The boost-phase, however, lasts only about three minutes, making early defense very difficult. Surely

satellite-based systems or boost-phase interception would soon be accompanied by Soviet "space mines" coasting close by, ready to be detonated at any time. An attempt to destroy such mines would predictably lead to war in space as a prelude to war on earth.

Then how about a ground-based defensive system—ready to be launched high enough and fast enough to "see" the missiles still in the boost-phase and to destroy each of them with a laser or particle beam at a distance of 5,000 miles or so? But huge aerodynamic forces would act on such a superfast interceptor, which is likely to have to be much bigger than the missiles it is supposed to counter. And—totally aside from the problems of beam-weapon technology—such a system could not be made sufficiently effective, reliable and secure against jamming and other countermeasures.

President Reagan states: "As we pursue our goal of defensive technologies, we recognize that our allies rely upon our strategic offensive power to deter attacks against them . . . their safety and ours are one." If we move toward one form of defense for ourselves and another for our allies, maintaining common interests and good will in the alliance will become harder.

Mr. Reagan's question, "Wouldn't it be better to save lives than to avenge them?" does not go far enough. Far better than saving some unknowable number of the 150 million or more Americans who might die in a nuclear war is saving all of them by preventing that war, through "deterrence of aggression by promise of retaliation." The President notes that "this approach to stability through offensive threat has worked." It will continue to work if we do not continually denigrate its effectiveness because we long for an alternative, because we want to justify military expenditures or because we are in love with technology. We should accept the reality of deterrence by threat of retaliation, make a strong effort to reduce the number of warheads from some 20,000 on each side to 1,000 each and seek a total ban on nuclear tests. We need a ban on all weapons in space and on damaging or destroying satellites. The contribution of satellite systems to our national economy, especially to our military capability, is too valuable to risk for a will-o'-the-wisp far more likely to lead to increased Soviet offensive forces than to a reduction of the threat to our lives.

Secretary of Defense Casper W. Weinberger says, "I would hope and assume that the Soviets . . . would develop about the same time we did the same kind of effective defense. . . ." Here is a question for those favoring leak-proof defenses: If the world will be a better place with high-technology boost-phase ballistic-missile defense, why don't we immediately open our space-age ballistic-missile defense program to the Soviet Union, if not to the entire world?

The Reagan initiative on space-age defense is likely to go the way of his early choice of individual superhardened silos for survivable basing of the MX missile. But it is a far more dangerous misconception.

[From the New York Times, May 18, 1983]

SPACE WEAPONS: ANDROPOV AND THE AMERICAN PETITIONERS

To the Editor: In his May 8 letter, Senator Larry Pressler criticizes for propaganda and lack of substance Secretary Yuri V. Andropov's letter to us of April 25. That letter responded to our "Petition for a Ban on Space Weaponry," which we wrote February 24 and cabled March 27 to the leaders of France, India, Japan, the People's Republic of China, the United Kingdom, the Soviet Union and the United States.

Our petition explicitly notes the continuing series of Soviet tests of an anti-satellite (ASAT) weapon and that "the U.S. will soon begin testing a much more sophisticated" ASAT. We observed that "if space weapons are ever to be banned, this may be close to the last moment in which it can be done."

"We join," we and our colleagues stated, "in urging the United States, the Soviet Union and other spacefaring nations to negotiate for their benefit and for the benefit of the human species, a treaty to ban weapons of any kind from space, and to prohibit damage to or destruction of satellites of any nation."

We noted also that in August 1981 the Soviet Union proposed in the U.N. General Assembly and the Committee on Disarmament a "draft Treaty on the Prohibition of the Stationing of Weapons of Any Kind in Outer Space." Despite its title, the draft (Article III) would require a "State Party not to destroy,

damage, disturb the normal functioning or change the flight trajectory of space objects of other States Parties, if such objects were placed in orbit in strict accordance with Article I, Paragraph I of this treaty"—that is, if such objects did not contain weapons. The Soviet draft presents some problems:

Under Article III, perfection of the Soviet ASAT and test and acquisition of the U.S. ASAT are apparently permitted (in preparation for their use against weapon-carrying satellites). Mature ASAT systems would put each nation only hours away from the loss of all its satellites; a treaty should ban tests of ASAT's.

Article II requires parties to use satellites "in strict accordance with international law," although the only satellites not given protection under the treaty are those carrying weapons; a treaty banning anti-satellite activities should limit ASAT's, not satellites.

Senator Pressler writes about the Soviets: "They have already targeted their propaganda on the U.S. space shuttle. Would the treaty allow them to target it with their ASAT?"

The draft refers to the space shuttle only in Article I, in the undertaking "not to place in orbit around the earth objects carrying weapons of any kind, install such weapons on celestial bodies, or station such weapons in outer space in any other manner, including on re-usable manner space vehicles . . ." [emphasis added].

The Russian text and the English text provided to the U.N. read as indicated, but the English translation used by some nations leaves out the "on" and reads ". . . including reusable manned space vehicles . . ." This translation is now recognized to be wrong, and the draft contains no threat to the space shuttle.

Mr. Andropov's letter restates the Soviet desire to proceed to negotiate a treaty based on the August 1981 draft. We would have welcomed replies from other leaders; even more would we welcome urgent negotiations between the United States and the Soviet Union to conclude an effective treaty that reduces the danger to all of us which an arms race in space implies.

RICHARD L. GARWIN.
CARL SAGAN.

Yorktown Heights, N.Y., May 11, 1983.

[The writers are, respectively, a physicist and a space scientist.]

STATEMENT OF ADM. NOEL GAYLER (USN, RET.), FORMER DIRECTOR, NATIONAL SECURITY AGENCY; FORMER COMMANDER IN CHIEF, U.S. FORCES IN THE PACIFIC; FORMER DEPUTY CHIEF OF NAVAL OPERATIONS (RESEARCH AND DEVELOPMENT), FAIRFAX, VA.

Admiral GAYLER. I would like to note for the record that I have been an experimental test pilot. I am reasonably familiar with aerospace technology. I used to run Navy development programs. I have been involved in nuclear target planning. I have been the Director of the National Security Agency, have been the Commander-in-Chief, Pacific. In civilian life I have been a member to the Defense Science Board, Los Alamos, Stanford Research, Rand, IDA, and many other such think tanks. I am reasonably current.

I want to describe the current and, as far as possible, the potential military uses of space, to assess the relative potential and advantage to the United States and to the U.S.S.R. I will not speak to the concerns of other countries or commercial concerns because you have already addressed them, Mr. Chairman.

I will talk briefly to the potential for defensive capability, the "Star Wars" scenario, the potential for the transfer—and this is very important—of space conflict to conflict on Earth, questions of human habitability of space and exploration that are involved, the potential for antisatellite capability, and a recommendation on balance.

The military uses that we now know about include communication, and that is the only way in which there can be high capacity military communication which can be secure and which can contain such things as pictures, maps, drawings, diagrams for the aiding of decisionmaking by military commanders, something that is getting far more complex, the networking.

And I call particular attention to the vital part taken by satellite communications in antisubmarine warfare, an area of warfare of enormous and vital interest to the United States and the Oceanic Alliances. It is the only way known to me to get communications, for example, from ships that are reasonably secure, and it is the only way known to me to make sure of reliable and redundant capability to execute any nuclear war plans, if necessary.

In the field of intelligence, you are very familiar with the capabilities of photo satellites, somewhat less familiar than is generally known about the capabilities to detect, for example, nuclear explosions from space, both in peacetime as well as in war, rocket exhausts and many other things which help to monitor what is going on in testing worldwide, including Third countries as well as the Soviet Union.

The great importance to signals intelligence, which I will not dwell on more, except to assure you that it is fundamental. The military observables, for example radar, for example infrared emanations from military vehicles, aircraft, and ships, the tremendous importance in peacetime and in crisis management of verifying the potential moves of an adversary and its central place in verification.

So much for the intelligence field.

For reconnaissance, again fundamental to signals intelligence, to photographic reconnaissance, to tracking and detection by radar and infrared radiation. I note that these things are of peculiar interest to the U.S. Navy and to our essential control of the sea, because in the naval warfare sphere location and identification is the name of the game.

You all know that we are emplacing most sophisticated navigation systems, three-dimensional positioning, of enormous civil as well as military potential, dependent upon a galaxy of satellites.

So far as actual weapons are concerned, it does not appear even in the most crude military sense that it is a good arena to place nuclear weapons for explosion on earth because of the difficulties of timing from orbit. Nuclear weapons in deep space has been one way to postulate to hide, and I just have to tell you that I think it has little fundamental importance.

Radiation weapons, whether we are talking about electromagnetic pulse or whether we are talking about directed-energy weapons, are certainly potential in space. I will talk a little bit more about directed energy. All I want to say about electromagnetic pulse is that any attempt to use that to clobber the opposition will certainly clobber ourselves too at the same time, given the global nature of the radiation.

The current capability of antisatellites, both in our hands and in the Soviet hands, is only against satellites in low orbit. The most important satellites to us are those in high orbit. To develop this ASAT capability against them would be a highly observable thing and if a treaty were to ban it, in my judgment we would know if that treaty were violated.

So far as antiballistic capabilities are concerned, the nonparticle type, the nonenergy types, ballistic intercept of ICBMs may have timing problems that are severe, to get from the right time in orbit to the right place in the trajectory of a ballistic missile, and the system and control problems that are so severe that it is very difficult to see that they would have any great capability to stop an ICBM attack.

So far as the directed-energy scenario goes, the "Star Wars" scenario, talking to lasers, talking to particle beams, both charged and uncharged, talking to nuclear-pumped X-ray lasers and their implications, I was prepared to talk a lot more about them, but I will say that the physical principles look unpromising for all of these as defenses against intercontinental ballistic missiles of populations.

It does not look, even from the standpoint of physical principles involved, that there is any likelihood you can get there from here.

When you take a look at the systems problems of simultaneously attacking in a very short length of time a very large number of missiles, identifying them and so forth, I simply say that so far as I know these problems are unaddressed and they are very tough problems, much worse than any air defense problem that we have ever had.

The countermeasures, even without these difficulties, are simple and obvious. I do not wish to discuss them further in an unclassified meeting, but that can be sustained.

The vulnerability of the presumed space platforms themselves which would direct this energy is very high and the tradeoff would be adverse.

Finally, as is obvious, there are many ways to deliver nuclear weapons. Not all of them are through space. So, as was previously discussed, a defense of its population by this technological development, in my judgment, not in this century, probably never. It is very difficult to defend the statement that something cannot be done.

It is easy to invoke science as a god and to say that if you spent enough money, you get the right people to work on it, eventually you will get an answer. That is true of some kinds of problems, but it is not true of other kinds of problems. This is not the kind of problem that is subject to the silver bullet remedy. It is a problem more like crime in the streets or the drug problem, or, as a military problem, it is like the antisubmarine problem.

Now I have been in and about antisubmarine warfare for over 40 years. Some very good scientists have over that period of time very heavily supported and made some remarkable technical breakthroughs in the detection and tracking and attack against submarines, but I want to tell you we are somewhat worse off with respect to defense against submarines today than we were when I got into the picture over 40 years ago.

I think this is that kind of problem. The potential for these weapons against satellites is, of course, somewhat better. Satellites are very much fewer; they are very much easier to track. You do not have to do everything in a hurry, and they are more vulnerable. The potential for breakout from a significant capability in a short length of time, I think, is practically zero.

Now let me talk to relative advantage. With respect to sea control, it is a judgment call. The capability to track ships on the ocean from space is adverse, relatively, to the United States because we have

the big ships and more dependence on them. On the other hand, the capability to deny observables is largely dependent upon being able to use satellites, and that is advantageous to the United States. So I call that one a wash.

So far as communications are concerned, because of our advantages in technology, the importance to us of secure communications, and a worldwide communications. I say satellites are a considerable plus to the United States. In intelligence they are a considerable plus to the United States because of the difference between an open and a closed society. We need them much more than they do.

So far as warning is concerned, I think the same observation so far as navigation. It is a wash between us and the Soviets. My judgment is that in the ABM defense business it is of no consequence because neither one has any capability.

Summing these things up, I would say that the relative military advantages accrue to the United States with the continued unthreatened existence of satellite systems. Consideration of human habitability, exploration, the concerns of other countries, commercial interests, are the things we should think about.

We should also think about the capability or the probability of the transfer of conflict in space-to-Earth conflict. I could dwell on that. I just say that I think it is very high.

The recommendation, then, that I would make is that we do indeed engage promptly in negotiations with the Soviet Union intended to preserve as far as possible the viability of satellite systems, both military and commercial, as well as human space exploration. I do not find there is any dilemma here. I think that to do so would improve our security, would improve our military capability, and would not at all, incidentally, be effective in war as well as in peace because it would inhibit the development of systems which could be used in war.

I think the problem of verification is important but that it is manageable, observing that satellites and operations in space are very much more visible than many other military things that we like to follow.

My unqualified recommendation is that we move out on this in the interest of the defense and security of the United States, and of the inhibition of warlike activity. Thank you.

Senator PRESSLER. Thank you very much.

Let me say that I think that the report that the Union of Concerned Scientists have prepared is a very excellent document. I do have one area that I initially would disagree, and that is regarding the Soviet ASAT, which uses land-based fixed launch sites. You suggest that it is a cumbersome and inflexible system, but I still think that it is a very dangerous system. It is operational.

Can we enter into an agreement without some assurance that it will be taken down? If we do not have a counter to it how can we enter into an agreement? That is a stumbling block. The Soviets' proposed treaty seems to overlook that, and many proposals overlook that. But that is a big stumbling block. The Soviets have an ASAT that is operational.

Mr. GARWIN. Our treaty does not overlook it. As I explained, we ban tests of any ASAT and so they would no longer be able to test it.

As Admiral Gayler says, it has been tested only in low-Earth orbit and it has been tested only with about 50 percent effectiveness. It has not been operational, as Mr. Adelman said, since the early 1970's. It has been operational maybe since 1977 or so, but it really is a poor system.

We do not need our low-altitude satellites for fighting and surviving nuclear war. We need our high-altitude, our geosynchronous, satellites for early warning, for communication, for navigation in intermediate orbit, and that the current Soviet ASAT cannot touch. They certainly would not be able to extend its capability without tests.

So, given the fact that if we demanded that the Soviets tear down their ASAT system, they would demand that we tear down our ASAT system and, given the difficulty Senator Tsongas indicated in verifying the absence of our ASAT system, I think the better part of valor here is to say to the Soviet Union "keep your ASAT, but you may not use it again."

In fact, we may even get some undertakings to reduce its readiness for use, but we could not, in my opinion, demand and verify that it had been totally destroyed and that they had not built a copy of it someplace else.

Senator PRESSLER. Thank you. I should say that I understand the Soviets have tested their ASATs over 20 times and over 30 to 40 percent of our potential satellites are at low-Earth orbit.

But, in any event, we will have more comment on that later. Senator Pell.

Senator PELL. Thank you, Mr. Chairman.

In connection with your draft treaty, has this been discussed with scientists outside of the United States, or is this only ours?

Mr. GARWIN. No. The current draft has not, but now it has been made public I suppose it will get across the oceans.

Senator PELL. The thought occurs to me that maybe this should be introduced in the Congress as some kind of a resolution. I am reminded of the treaty specifying no weapons of mass destruction on the seabed floor and also the Environmental Modification Treaty, both of which flowed out of resolutions which I introduced here, reversing the normal process of treaty formulation.

Perhaps it would be a good idea if you sought some friendly Senators to introduce this as a resolution, thus giving it a more official imprimatur.

Mr. GARWIN. Is that an offer?

Senator PELL. Also, I would be very interested to find out what your colleagues in other nations, including the Soviet Union, felt about the specifics of your treaty. As a layman, obviously I am no judge, but that is a thought. Perhaps the chairman might be persuaded to introduce such a resolution, or others of our colleagues. I think most of us could have our arms twisted pretty easily.

I think in view of speed I am going to submit a couple of questions for the record and I hope, Mr. Chairman, the record will remain open for the that purpose. We still have one more witness, and there is a press conference afterward, so I would desist.

Senator TSONGAS. As a point of information, we have moved the press conference here so as soon as this is over we just turn ourselves around and we will have the conference. So we do not have the time constraint.

Senator PELL. We put the scientists here and we will stay here.

Senator TSONGAS. We will work it out in some verifiable fashion.
[Laughter.]

Mr. GOTTFRIED. Thank you.

Senator TSONGAS. What bothers me about all this is that there does not seem to be among serious scientists that kind of disagreement, if you take Dr. Teller out of the equation. I am just curious as to what happens in the military. General Lamberson was not apprised of the speech.

You have been in the military your entire career. What goes on inside when they turn on the television set and there is the Teller-inspired "Star Wars" speech? Is there any generation of reaction within that say this is not how we should spend our moneys, that it should be expended in these systems? What happens?

Admiral GAYLER. I can only speculate as to what happened in this instance, but I can remember other things like that when I had responsibility for some development programs and, generally speaking, it was: "Oh, God, here we go again." It was regarded as a problem that you had to solve somehow within the framework so that the important military programs did not get clobbered by these will-o'-the-wisps.

Senator TSONGAS. Because there seems to be agreement that we have a conventional weaponry shortfall that has to be addressed, and to the extent we engage in this kind of multibillion-dollar activity that really is going to suffer.

Admiral GAYLER. I think the kind of activity to indulge in here at the present time should be limited to careful scientific analyses, simulations, and system studies, and those primary physical tests, proof of principle tests, in the laboratory which have yet to be done. Most of this stuff about the deposition of energy and all of that from energy beams is mere speculation.

There is some testing, very little. I would confine it to that rather low level of expenditure, for the high level of thought and intelligence, for quite a while before displacing other developing programs.

Senator TSONGAS. I would just like to make one request, and that is Secretary Weinberger has proffered the hope to the American people that we can have a defense system perfectly capable vis-a-vis ICBM's and perfectly capable vis-a-vis cruise missiles. If you ever in your travels come upon a scientist who shares that view, could you send his name to us so we may sit down and just talk with him?

Admiral GAYLER. I do not expect ever to see such a scientist.

Senator TSONGAS. Have either of you run into anybody who would fit that qualification?

Mr. GOTTFRIED. I have not.

Senator TSONGAS. Dr. Garwin, have you?

Mr. GARWIN. No.

Senator TSONGAS. Do you expect to find anybody like that?

Mr. GARWIN. One can always hope.

Senator TSONGAS. Well, it says something for where we are that that Secretary of Defense can make a statement that not one scientist around the country would feel comfortable getting up and saying this is really good stuff.

Admiral GAYLER. Senator Tsongas, what we are observing is the will to believe, and it is irreducible. People will believe in hopeful

things. Cancer sufferers still go to Mexico and get shot full of laetrile and this is that kind of operation.

Mr. GOTTFRIED. The other panelists have asked to put things in the record. I would like, with your permission, to put an article out of Science, from May 13, in the record. This is the journal published by the American Association for the Advancement of Science. This article has a detailed discussion of a point that you discussed at length with Mr. Adelman, that is, the question of what are the problems with verifying the Threshold Test Ban Treaty and the 150-kiloton limit.

I would just say that there are highly qualified scientists who advise the Government, and are on the Government advisory committees, who do not agree that there is any evidence for a violation of the 150-kiloton limit. With your permission, I would like to see this summary, which quotes the people involved, entered into the record of the hearings.

[The article referred to follows:]

[From Science, May 13, 1983]

SCIENTISTS FAULT CHARGES OF SOVIET CHEATING: EXPERTS SAY THAT THE UNITED STATES LACKS GOOD EVIDENCE OF SOVIET DISHONESTY ON STRATEGIC ARMS TREATIES

(By Jeffrey Smith)

Senator James McClure, a conservative Republican from Idaho, seems to be privy to a lot of sensational information about Soviet compliance with arms control treaties. Just the other day he received a "comprehensive statistical study of Soviet weapons testing," which proves that the Soviets have repeatedly violated the Threshold Test Ban Treaty. He claims to have seen official documents that describe Soviet testing of two new intercontinental ballistic missiles in direct violation of the SALT II treaty. He also has government reports on the secret stocking of Soviet IOBM's and the deployment of banned Soviet missiles. It all adds up, he said, to "a consistent pattern of Soviet violations of the whole range of arms controls treaties."

If true, the allegations would probably force the United States "to reassess its entire spectrum of negotiations and relations with the Soviet Union," as McClure says. There is only one problem. The issue is gray and not black and white. Interviews with scientists, government officials, and outside experts with access to classified information reveal that considerable doubts exists about all of his charges. They say that McClure has at best exaggerated and at worst flatly distorted the facts.

This obstacle notwithstanding, McClure and some conservative congressional colleagues are pressuring the Administration in a series of speeches and press conferences to charge the Soviets officially with treaty violations. They say that their aim is to acquaint the American public with the depth of Soviet treachery and the enormity of the Soviet threat. In so doing, they hope to develop support for the President's strategic weapons-building program, particularly his proposal for 100 MX missiles, and to defeat the movement behind the nuclear freeze. They also intend to free the Pentagon from existing arms control constraints. "In those areas where there have been violations, it would be foolish for us to continue to abide by that agreement," McClure says.

Administration officials have hinted that they support the charges of Soviet cheating, although they have yet to produce the evidence and make a formal statement. President Reagan has stated, for example, that "we have reason to believe that there have been numerous violations" of the Threshold Test Ban Treaty, which prohibits the testing of nuclear weapons with a yield of more than 150 kilotons. When reporters recently asked him whether the Soviets had violated the SALT II treaty, he answered jokingly. "When have they stopped?" Only when Reagan was asked for details in a formal news conference did he back away and acknowledge that the evidence might not be clearcut. "It is difficult to establish, and have hard and fast evidence, that a treaty has been violated," he said on 22 April. But Reagan considers the allegation serious enough to warrant a formal investigation by William Clark, his national security adviser,

and a panel of top government officials. "Whether or not I'll be speaking out or not" depends on this study, Reagan said. No deadline has been set for a report.

McClure and his confederates, such as Senators Orrin Hatch (R-Utah) and Steven Symms (R-Idaho), are frustrated by the delay. "Mr. President, please don't allow yourself to be pushed into a corner by overly cautious advisers," McClure said recently. "If you allow yourself to be hamstrung by doubts, you will always find them." McClure, a right-wing attorney who opposed the Panama Canal treaty and voted for development of the neutron bomb, says that he has no doubts whatsoever. Evidence that the Soviets are illegally testing two new missiles is "open and shut." Evidence of the deployment of banned Soviet missiles is "strong." Evidence of secret missile stockpiling is based on "careful conservative estimate." And evidence of test ban treaty violations is "clear and conclusive," he says. "I strongly believe that the American people need to be told the straight truth about Soviet behavior."

One of McClure's "truths" is that the Soviets have repeatedly violated the Threshold Test Ban Treaty. McClure says this is proved by a comprehensive study that "reflects a majority conclusion among those who have analyzed the Soviet test data." The study shows, he says, that the probability of substantial violation is 95 percent or greater. "These conclusions are almost completely unaffected by the uncertainty attributed to our seismic yield determinations," McClure says. "There is now strong agreement on this judgment within the government."

McClure declined to be interviewed about any of his sources, and his staff is coy about the authorship of the nuclear testing study. "All I can say is that it was performed by experts within the field," says David Sullivan, a staff aide. Notwithstanding the lack of attribution, McClure's assertion was repeated unquestioningly in the New York Times and other publications, as were many of his other charges.

Most experts consulted by Science, both inside and out of government, expressed doubt that such a study exists. Eugene Herrin, for example, is a seismologist at Southern Methodist University who chairs the advisory panel on yield estimates for the Defense Advanced Research Projects Agency (DARPA), which funds the bulk of the government's work on this problem. Herrin, who has access to classified information, says that he has never seen a study that fits the description given by McClure. In addition, he says, "from a scientific, technical point of view, the evidence is insufficient to assert that the Soviets have been cheating—certainly in no more than a very, very few cases—and even then not with a high degree of confidence."

Herrin says that some of the apparent violations could actually fall under the so-called "whoops" provision of the treaty, which he helped to negotiate in 1976 as part of the U.S. treaty delegation. The provision recognizes the difficulty of estimating exact test yields in advance, and allows each side "one or two slight unintended breaches per year" of the 150 kiloton limit. Pentagon officials peg the number of suspicious blasts at 15, or about two per year since the treaty was signed.

There is speculation that McClure got his data from a paper prepared by Donald Westervelt, a physicist at Los Alamos National Laboratory. The paper has not been peer reviewed or formally endorsed by any government panel, and some other scientists at Los Alamos say that they disagree with its conclusions.

The paper is an independent analysis of a recent classified study by two physicists at Lawrence Livermore National Laboratory, where most of the government's work on seismic verification is conducted. The study is entitled "An Analysis Based on Seismic Data of the Pattern of Soviet High-Yield Nuclear Tests from March 31, 1976, through December 31, 1981." Warren Heckrotte, one of the authors, recently summarized the conclusions as follows: "the distribution of seismically measured yields of Soviet weapons tests is not inconsistent with Soviet observance of the 150-kiloton limit. However, the distribution is also not inconsistent with a distribution of actual yields in which there are some events above 150 kilotons." In short, the evidence is not conclusive. Peter Moulthrop, his co-author, told Science that "if the Soviets were taken into court for cheating, there would be no case against them. They may have cheated, but there is not a case against them that can be substantiated." He adds that this conclusion is uncontradicted by any Soviet tests since the study was completed.

There is a division of opinion over the Livermore report within the seismological community, stemming from substantial uncertainty about the correct method of calculating Soviet yields. Herrin and many others associated with DARPA

favor estimates derived from the magnitude of seismic waves that travel through the earth's mantle, corrected only slightly for regional variations in geology. Moulthrop, Heckrotte, and some others at Livermore accept this approach, but favor a more substantial correction for regional variation. Another group, which includes Lynn Sykes of Princeton University and Jack Evernden of the U.S. Geological Survey, favors estimates derived from seismic waves that travel through the earth's crust. But scientists in every group agree that there is no conclusive evidence of Soviet cheating.

Donald Helmberger of Caltech, who serves on the DARPA panel, says that "we simply don't know if the Soviets are cheating." Donald Springer, the deputy manager of Livermore's seismic monitoring program, says that "most people in my laboratory believe that the evidence is equivocal. The Administration and the military just want to believe the worst." Charles Archambeau, a seismologist at the University of Colorado who has been a consultant to DARPA for 20 years, says that "no rational scientist would draw the conclusions that the present Administration is drawing. It's fairly evident that there's a lot of politics involved in this." Similar viewpoints are expressed overseas. Ola Dahlman, a research director at the Swedish National Defense Research Institute in Stockholm, says that "we have so far no convincing evidence that [the Soviets] have exceeded the limit." The British Ministry of Defense has taken a similar position.

The only scientist that McClure cites by name is Harold Agnew, a former director of the Los Alamos National Laboratory. In a recent letter to Science (8 April), Agnew wrote that Soviet tests "appeared to us to range as high as 400 kilotons based on detection criteria which were in effect at the time of the initial agreement." Those criteria have now been thoroughly discredited by scientists who remain active in the field, and Agnew admits that official government estimates of Soviet test yields have never been as high as 400 kilotons.

Administration officials have cited the allegations of Soviet cheating as the principal justification for an attempt to renegotiate the Threshold Test Ban Treaty and to suspend indefinitely all negotiations on a comprehensive nuclear test ban (Science, 18 February, p. 819). Their argument has been paraphrased by McClure, who asks, "How can one plan to reduce the allowed nuclear test threshold when the current threshold is being exceeded?" The Soviet embassy in Washington, in a detailed rejection of the renegotiation plan on 12 April, replied that "the U.S. side has no basis for raising the issue of 'improving' the verification provisions." It said that once the treaty has been ratified, verification questions can be resolved through routine consultations, as the treaty provides. It also said that the Soviet Union is willing now "to resume the trilateral negotiations in order to finish drafting of the treaty on complete and general prohibition of nuclear tests."

To McClure, this rebuff—in and of itself—provides "conclusive evidence of Soviet cheating." And he lurches onward, finding additional examples in the more arcane aspects of the SALT II treaty, never ratified by the U.S. Senate. Under the treaty, neither side may flight-test or deploy more than one new missile. A new missile is one that did not exist as of 1 May 1979 and that varies significantly from all old missiles. On 26 October 1982, the Soviet Union tested a new solid-fueled missile that matches the MX in size, and declared that it would be the one permitted new missile. Subsequently, on 8 February, it tested another missile that the Soviets said was merely a modification of an existing missile, the SS-13, and therefore not new.

The question confronting U.S. intelligence analysts is whether the second missile varied so much from the SS-13 that it is in fact a second new missile. William Jackson, a former director of the State Department's principal arms control advisory committee, has learned that all U.S. intelligence-gathering systems were not operating on the date of the test, so that data are unusually sparse. Nevertheless, it appeared at first that the weight-carrying capability of the missile was significantly more than that of the SS-13. Jackson, who is now a guest scholar at the Brookings Institution in Washington, D.C., says that his sources in the intelligence community characterize this conclusion as "preliminary—more inference than fact." It also appeared at first that the missile's sole warhead was no light that the Soviets could add more later. This, too, would be a SALT II violation. But Jackson says that this too is a questionable assertion, and that firmer conclusions must await additional test launches. Several intelligence sources, who asked not to be identified, agreed. "In general, one test is not conclusive," one said. "The way you arrive at confident conclusions, as opposed to suspicions and exaggerations, is that you watch a series of tests."

In March, a panel of senior Administration officials found only ambiguous evidence that the second test was in violation of the treaty. This is why a second group was impaneled by the President. None of this is good enough for McClure, who believes that there is "an open and shut case." McClure admits that his purpose in raising this point is to free the United States from its own obligation under SALT II not to test two new missiles. President Reagan proposed recently that two such missiles be deployed in the late 1980's and early 1990's—the MX and another, smaller missile.

McClure also charges that the Soviets have secretly gathered "a significant, covert . . . strategic ICBM force," which could be rapidly launched from existing silos in a second wave. But none of these missiles are stored near the silos, as prohibited by SALT II, and—according to a Defense Department handbook on Soviet weapons—the liquid-fueled rockets cannot be loaded into the silos in less than a few days. The Soviets could also level a similar charge at the United States. The Reagan Administration wants to produce dozens of extra missiles, each capable of being loaded into an existing silo.

Sources on Capitol Hill speculate that much of McClure's information—tenuous and vague as it is—comes from the White House. Robert Sims, the director of public affairs for the National Security Council will say only that "we try to respond if interested members of Congress ask us for information." Should the suspicions be correct, McClure is merely a pawn in a deliberate strategy to raise the issue of Soviet cheating without having to prove it one way or the other.

Senator TSONGAS. Finally, my reading of the testimony this morning by Mr. Adelman and Mr. Ikle was that they are going to go ahead with the tests. They are going to drag out any negotiations, arguing they have to assess the verification problems, and we are going to be into this thing without anything having been done to stop it. Would you disagree with that assessment?

Mr. GOTTFRIED. I think it is very disappointing that 8 months since you held hearings on this question, on the resolution that was introduced by the chairman in the last Congress, where Dr. Garwin testified, that we have a statement that, as far as I can tell, is hardly any different from the one that Mr. Rostow presented.

Being an academic I am all in favor of careful, timetaking investigations, but I think this has been carried to an excess and I would hope that with the new leadership in ACDA that there can be far more rapid movement toward a position.

I cannot understand why it takes well over 2 years for an administration with all the powers and resources that it has at its disposal to come up with the kind of statements that we have been hearing.

Senator PRESSLER. Thank you very much.

We shall now call on Carol Rosin.

Admiral GAYLER. Mr. Chairman, may I volunteer a statement somewhat related to this and responsive to a concern of yours, Senator Tsongas?

You were asking previous witnesses about the issue of Soviet Union as a focus of evil. I would like respectfully to call to the attention of this committee the seminal speech made by George Kennan yesterday on that subject in this city. I think that he is better qualified to talk about the true nature of the Soviet Union, which he certainly did not applaud in that speech, which is pragmatic and useful, than almost any spokesman I can think of on the American scene.

Thank you.

Senator PELL. Just exactly as was his article. I remember I was in the Foreign Service in Eastern Europe when his famous X analysis came out and really alerted us to the dangers of the Soviet Union.

Admiral GAYLER. The speech yesterday was really so informed that it ought to be the basis of our appraisal.

Senator TSONGAS. The Kennans are out of fashion these days, Admiral. I would just point that out.

Admiral GAYLER. The truth will make you free, Senator.

Senator TSONGAS. What we will do is after the testimony we will simply have the—we will sit at the table and the press will remain for the conference, will come up this way, I guess.

Senator PRESSLER. Miss Rosin, we welcome you to the committee and we look forward to hearing you. If you could summarize your statement, we will then have some questions.

STATEMENT OF CAROL ROSIN, PRESIDENT, INSTITUTE FOR SECURITY AND COOPERATION IN OUTER SPACE, INC., CLARKSVILLE, MD.

Ms. ROSIN. Thank you, Senator Pressler.

I appreciate the opportunity to be able to speak before you today because this is an issue in which I have been involved for nearly 10 years. I know that although there are other issues that need to be dealt with that are equally as important simultaneously, I believe this issue is a priority because it gives us the opportunity to finally put a literal lid, a ceiling, on the arms race. This is the only time in history when this can be done. I think we are all well aware by now that we must stop the space arms race before it begins with irreversible momentum.

There are some resolutions before the Congress—Senate Joint Resolution 28, Senate Concurrent Resolution 16, House Joint Resolution 120—that I will discuss and a possible new perspective that I think we should include in our equation and support. This new perspective does not need to include the old war-peace rhetoric of cost estimates, facts and numbers games. It includes new facts and new ways of looking at the old one.

In fact, the old rhetoric about the fact that we now have to prepare for war in order to prepare for peace really does not work in space unless we allow a small group of weapons-oriented individuals to design it that way starting from this point on.

We have only one opportunity to prepare for peace on Earth via cooperation in space and it will be historically unforgiveable, I believe, for any one of us to apply any degree of our knowledge to designing space in a way that includes the old earthbound, weapon-defense oriented nationalistic kind of "man-made" boundary viewpoint which we cannot possibly really design in space because space truly does belong to all of humanity.

As I was walking to the table, somebody handed me an article that says: "Save us all, no weapons in space!"; and I think that is what our responsibility is to do.

I have been a corporate manager of an aerospace company, so this industry is not new to me. Neither are the games, the secrets, dangers and potentials of space and defense. I was also a spokesperson for the late Dr. Wernher von Braun, whose thinking abhorred the notion of the introduction of weapons into space. He charged me with following this issue upon his death.

As vice president of one of the largest chambers of commerce in the country, I became very well aware of the employment and the profit potential of the armaments industry. I noted a choice: that we could either be building weapons systems or peaceful space systems and spacecrafts. I also saw great opportunity for new kinds of businesses in a creative new kind of marketplace.

As a participant in a number of international conferences, including the UNISPACE '82 conference last summer in Austria, I found over 90 country representatives signing statements that they do not want to see weapons in space mainly because weapons would block many of the opportunities that they have to in fact reap the benefits of space.

We have only a few short months in which to put this lid on the arms race. Beyond that time, the vested interests, the finances, the jobs, the positions, the egos, the project developments will be moving in a form of momentum that will be irreversible, so we really do have to act now.

Soon we will not be able to verify the existence of weapons in space, nor will we be able to remove them. And we are almost at that irreversible position now, if you look at the description of some of the jobs now in the Department of Defense, NASA, industry and the perspectives of various individuals and experts.

Since we now have enough defense systems, we should now be thinking about a new kind of defense system that is based on cooperation on this planet among all of our neighbors. No one can seriously think or talk about unilateral disarmament, but we desperately need a U.S. initiative preventing a space weaponry race. No one is looking at this as a panacea and no one is neglecting the fact that there are great antagonizing tensions between the superpowers, at least on the Government level, although if you look at the people level there are hundreds of businesses and organizations doing exchange programs as we speak.

No one is looking at foolish types of disarmament solutions that lay one country down to the manipulation of another. However, some fresh alternatives that include the perspective that goes beyond the scope of the traditional fear building war game types of approaches that have been used on Earth need to be included in our equation as we develop space for all of humanity.

We all know that the only way the United States can be secure is for the entire world to be secure, and knowing the facts and numbers, if we include these kinds of fear reducing perspectives and alternatives in our equation surely we will not even need to continue the discussion about whether or not or whom to go back to the negotiating table to ban all kinds of weapons from space. Surely we will not sign any kind of an agreement or even talk about one that allows for any kind of loopholes to exist that would allow one weapons system to be only a first step in the negotiations, while other weapons systems are allowed to continue in their research and development for outer space.

This is the time to look at problems with new eyes. The old rhetoric does not work any more. It is also no longer too idealistic or crazy to accept the notion that we can and must ban all kinds of weapons from space. On the contrary, in fact, it is mandatory to ban weapons from space if we are ever to have peace on Earth.

Prominent experts, from scientists to some of you and your colleagues, are signing petitions and resolutions to support this notion. It is only obsolete thinking and fear that is stopping us from signing a treaty this weekend. The time has come, if we are ever going to achieve peace on Earth. Now is the time to do it—and to discuss it in further hearings.

As a first step, I urge you to immediately cosponsor and support actively two important resolutions. The first resolution is Senate Joint Resolution 28, sponsored by Senators Tsongas, Hart, Hatfield, Cranston and others which already has 118 cosponsors, and Congressman Moakley's House Joint Resolution 120, calling for immediate negotiations for a ban on weapons of any kind in space. As you know, this resolution could become law.

A second resolution is Senate Concurrent Resolution 16, sponsored by Senators Matsunaga and Pell, which expresses the sense of the Congress that the President should initiate talks with the Government of the Soviet Union and other governments interested in space activities to explore opportunities for cooperative East-West ventures in space as an alternative to a space arms race.

The integrated content of these two resolutions is the basis of the work that needs to be done to stop the weaponization of space and create international and world cooperation among world citizens on this planet.

Senator Pressler's resolution is a good one, Senate Resolution 43, calling for a halt to ASATs as a first step, but it should only be viewed as a part of the whole package, with all due respect, but not as an overall program by itself, as it will be included in an overall treaty to ban all kinds of weapons from space.

As you support these concepts you will have support from your constituents, from the scientists who are signing the petitions that Richard Garwin mentioned, and the 100 or more U.S.S.R. academicians—the head scientists—who have signed a petition in the Soviet Union, the physicians, environmentalists, students, educators, farmers, construction workers, lawyers, mothers, and all world citizens. This is the time for your leadership on this issue on behalf of Congress.

I repeat, the most desirable thing for the Foreign Relations Committee to do right now is to report out the two resolutions I mentioned as priorities, and to continue hearings.

There are many uses for positive space development, of which volumes have been written. What we want to make sure is that all of them are accomplished, including a good one that would relate specifically to our defense systems—such as a global security satellite monitoring system that many people have discussed and presented over the years.

Where I differ with the initiative taken by Senator Pressler is, in his recommendation the most important first step that needs to be taken in order to stop the arms race from escalating into space is to deal only with halting antisatellites. This is the time to negotiate a comprehensive treaty to ban all kinds of weapons from space. Why should we take the chance on a misinterpretation or a loophole in this, as we have with other treaties in the past, when we have newer and better space projects to fill all possible loopholes?

What is wrong with the President's "Star Wars" scenario is that it does not change the game, nor does it recognize the new game that is,

in fact, taking place on this planet. What is needed is a reduction of fear, not more of the same. The President's scenario omits positive steps like negotiating a ban on weapons from space, and commits us to continued weaponry and rivalry.

The President's "Star Wars" proposal would only prolong the arms race for 10 or 20 or more years at exorbitant, unnecessary, and unacceptable expense and cost to humanity. It is in no way an effective arms-reduction proposal.

Some leaders in the defense establishment are on the threshold of testing a highly sophisticated antisatellite weapon, perhaps even this summer, beginning the arms race in earnest. Meanwhile, there are hundreds of groups and businesses, as I mentioned in my written testimony, participating in cooperation through such projects, and including search-and-rescue satellites, U.S./U.S.S.R. compatible, live, two-way audio-visual, Los Angeles-to-Moscow satellite dialog and music exchanges, and other projects going on.

I will conclude very quickly.

Senator PRESSLER. I must interrupt here. My colleagues and I have made a determination that we would go to questions at this point, if that is all right.

Ms. ROSIN. All right. That is good.

[Ms. Rosin's prepared statement follows:]

PREPARED STATEMENT OF CAROL ROSIN

Thank you very much for giving me this opportunity to appear before the Senate Foreign Relations Committee today. The space weapons issue is one in which I have been involved for nearly 10 years. I have come to believe it is one of the most important issues of our time, one which affects almost every other issue. While other important issues must be worked with equal emphasis simultaneously, this issue offers us an immediate, realistic time and place to end a frightening new phase of the arms race before it begins.

Having been a corporate manager of an aerospace company and a consultant to various industry defense contracts, I have been directly exposed to the games, secrets, dangers and potentials of space and defense systems.

I was also a spokesperson on occasion for the late Dr. Wernher von Braun, noted father of rocketry. There is ample evidence of his deep concern that space be used for the enhancement of civilization, not its destruction. His thinking abhorred the notion of the introduction of weaponry into space, an issue which he charged me to follow before his death.

As vice-president of one of the largest chambers of commerce in the country, I became aware of the employment and the profit potential of the armaments industry. I also saw that the same industry could develop these potentials by building either weapons systems or peaceful spacecraft type systems. And I saw great opportunity for new kinds of businesses and creativity in the market place.

As a participant in international technical and politically oriented conferences including the International Astronautical Federation (IAF), Rome, Italy, and the United Nations Second Special Session on the Peaceful Uses and Exploration of Outer Space (UNISPACE '82) Conference in Vienna, Austria, I have observed the world's citizens, to whom space really belongs, supporting peaceful, global space initiatives which would help bring them space-age benefits. The over 90 country representatives present at UNISPACE '82 signed a statement expressing their desire for no space weapons.

We, all who hear this message, have only a few short months in which to put a lid, a literal ceiling on the arms race which only we, who learn about this issue, can do by stopping earth weapons systems from escalating into space. Beyond that time, it is likely that the vested interests (i.e. finances, jobs, positions and projects developments) will be so far under way in a weapons development direction, that the momentum of space weapons systems and the mindset will be irreversible. Weapons in space will be hard to verify and very difficult to remove. We are almost in that irreversible state now. Already we see the

Department of Defense, the space command, industries, individuals, and even NASA gearing up for a star wars momentum. But, if we can stop the testing and production of all space weapons, if we can sit down and negotiate a comprehensive treaty that prevents any nation from placing weapons in space, we might then accomplish two things. First, our frontier would be for peaceful development only, and second, it just might possibly be the catalytic action that could result in real arms reduction here on Earth.

The speakers you have invited to testify today are as diverse in their perspectives as are those on your committee. We represent the range of choices and approaches available to achieving our common goals of security and peace. While some experts believe weapons in space are necessary, other experts who want to see no weapons in space play old games which they feel don't permit them to say clearly what they really want. For example, some of the latter people say they do want to ban weapons from space, but cannot call their drafted treaty "a treaty to ban all kinds of weapons from space" because the Soviets said this first . . . and it wouldn't be good politics to use their language even though this is our common goal. So, they call this treaty an "anti-satellite treaty," "a first step," knowing this "first step" could just as easily be included in negotiations for a comprehensive treaty to ban all kinds of space weapons. Since I don't believe we have the time to play this old and dangerous game, and I've been playing in a new and more exciting game that has already begun, my testimony represents what I believe the majority of people on this tiny planet, including your constituents, desire—especially as they become more intelligent about the choice—and the results.

We cannot expect to simply stop the military industrial complex or the minds that create the rhetoric that creates warfare, unless we present realistic available alternatives that will provide as much room for creativity, security, economic and other benefits. We know "danger facts" about war. We need to spend our energy today focusing on ways to build joint U.S./U.S.S.R. and world space ventures . . . to build our joint security system for our own protection and survival.

No one can seriously think or talk about unilateral disarmament. But we desperately need a U.S. initiative preventing a space weaponry race. No one is talking about quick panaceas here. No one is neglecting the fact that great antagonizing tensions exist between the superpowers. And no one is proposing foolish type solutions that lay one country or the other down to the manipulation of the other. However, some fresh alternatives need to be looked at that go beyond the scope of the traditional war game type approaches . . . which stand in the way of peace.

This is the time to look at old problems with new eyes. The rhetoric that "if you want peace you have to prepare for war" is an achronism of the past that the people of the nation and the world are no longer prepared to accept as a viable alternative. As we humans get smarter faster, we begin to apply our new knowledge and to see things differently. For example, we are learning that space belongs to all people and whomever else might be out there.

It is no longer unrealistic, too idealistic or crazy to accept the notice that we can and must ban all kinds of weapons from space. On the contrary it is mandatory to ban space weapons if we are to have a peaceful world. Prominent experts from scientists to some of you and your colleagues are signing petitions and resolutions to support this notion. In fact, it is crazy to believe that more weapons systems will make us more secure. Only obsolete thinking and fear are stopping us from signing the treaty this weekend. All reality begins with a great idea.

The time has come. If we are ever going to achieve peace on earth, now is the time to do it. Peace in modern times implies a far greater sense of well being than can be obtained by the just absence of war. We can provide that sense of well being, now, as we move into an information based society.

NEGOTIATE TO BAN ALL SPACE WEAPONS NOW

As a first and totally comprehensive step, I urge you to immediately co-sponsor and support actively two important resolutions. The first resolution is S.J. Res. 28, sponsored by Senators Tsongas, Hart and Hatfield, which already has 118 co-sponsors and Congressman Moakley's H.J. Res. 120, calls for immediate negotiations for a ban on weapons of any kind in space. As you know, S.J. Res. 28 could become law. The second resolution is S. Con. Res. 16,

sponsored by Senators Matsunaga and Pell, to express the sense of the Congress that the President should initiate talks with the Government of the Soviet Union, and with other governments interested in space activities to explore the opportunities for cooperative East-West ventures in space, as an alternative to the arms race in space. The integrated content of these two resolutions is the basis of the work that needs to be done to stop the weaponization of outer space and create international cooperation.

Senator Pressler's resolution, S. Res. 43, calling for a halt to ASATs as a first step, should be viewed as part of a whole package, but not as an overall program by itself. By calling for a halt to ASATs, or an ASAT treaty alone, we play a political game that falls into the old structure which has allowed other weapons systems to slip through the loopholes left by not calling for a total space weapons ban. If we really do want to stop weapons from moving into limitless space, why don't we say it like we mean it?

As you support these concepts, you will have support from your constituents, the U.S. scientists signing the petition of Richard Garwin and Carl Sagan, the more than 100 academicians (head scientists) who have signed a Soviet petition, the physicians, environmentalists, students, educators, farmers, construction workers, lawyers, mothers, and all world citizens. This is the time for your leadership on behalf of Congress to be exerted—with truth, integrity, a sense of responsibility and coverage.

It is now time to negotiate a comprehensive treaty to ban space weapons of all kinds in order to close the loophole in the 1967 treaty which agreed to "ban weapons of mass destruction", while allowing the development of other weapons. Unfortunately, the Pressler resolution goes only part way, too. What is needed is a statement of commitment to return to the table immediately to negotiate a totally comprehensive agreement not one that leaves loopholes and misinterpretation of intentions and sincerity.

I repeat that the most desirable step would be for the Foreign Relations Committee to report out S.J. Res. 28. In the Senate this move is led by Senators Tsongas, Hatfield, Hart, Cranston and others. This resolution calls for immediate negotiations to draw up a treaty to ban all weapons in space. This would prohibit production, deployment or use of any space-based, air-based, or ground-based weapons system which is designed to damage, destroy, interfere with the function of any spacecraft of any nation and the stationing in orbit around the Earth, or any celestial body, or at any other location in outer space of any weapon which has been designed to inflict injury or cause any other form of damage on the Earth, in the atmosphere, or on objects placed in space. Isn't this what we all want? If so, we have no time to lose. Then, look at S. Con. Res. 16, to develop joint U.S./U.S.S.R. and other country space ventures. Think of the new kind of security this will provide—about exciting new space developments we can create.

USE SPACE FOR POSITIVE DEVELOPMENTS

What we want is the absolute maximum use of space for the development of human potential, and a healthy environment. Space weapons will block these developments. Every nation should feed into a system that shares information for the benefit of all people. Just as the colonies united to form the states, so is the world now forming in a way that we can stop border disputes and share resources.

There are great possibilities for further positive uses of space such as crop and weather reporting, search and rescue operations, exploration for minerals and other resources, and vast possibilities for the scientific use of space. The scientific exploration of the universe has just begun. All of this would be overshadowed and jeopardized if we think in terms of waging wars in space which, according to the scientists, would almost certainly lead to wars on earth.

One of the many cooperative ideas that has been suggested is for the development of a global satellite security monitoring system, which could be designed to meet our defense requirements and help to prevent wars on earth. Our military people who want to provide security will have a new kind of job based on a new kind of security—without weapons—and the entire job market will open up. Everything is in place to change the game from war to peace—and space.

Where I differ with the initiative taken by Senator Pressler in S. Res. 43 is in the recommendation that the most important first step that needs to be taken in order to stop the arms race from escalating into outer space is to deal only with halting ASATs. This is the time to negotiate a comprehensive treaty to

ban space weapons of all kinds which is the recommendation of S.J. Res. 28, because we now have available the intelligence and the technology and to our long and short range future on Earth and in space.

What's wrong with the President's star wars scenario is that it doesn't change the game. What is needed is a reduction of fear . . . not more of the same. His scenario omits positive steps like negotiating to ban all weapons from space . . . and commits us to continued weaponry. The President's star wars proposal would only prolong the arm race for ten or twenty years at exorbitant expense. It is in no way an effective arms reduction proposal.

Note that in the old, nationalistic, earthbound game the Americans deployed the first anti-satellite (ASAT) with nuclear tipped warheads in the late 1950's, but dismantled it in the 1960's when it was discovered that its detonation would blind not only the "enemy" satellites but U.S. satellites as well due to the electromagnetic radiation pulse which surrounds our earth. Responding, Soviets have tested, over 20 times with an approximate 50 percent success rate, a much less sophisticated, non-nuclear ASAT which cannot reach American high orbit satellites. Unlike the "catch-up game" on Earth where we build a weapon and then they build it, in space people would probably play a "leap-frog game" where the Americans would build one kind of weapon, and then the Soviets would build a different and better kind, and then counter measures for counter measures for each system would get developed, and so-on. Others will soon join in, and more people will suffer on Earth while money is human "intelligence" gets applied to more weapons instead of to food distribution . . . environmental protection, etc.

Some leaders in the defense establishment are on the threshold of testing a highly sophisticated anti-satellite weapon this summer, beginning a new race in earnest. Do these individuals not see what the people of planet Earth want—or are doing?

While these few people continue hanging onto their desire to "fight" for peace, there are hundreds of U.S. groups and businesses already working in cooperation with Soviet people and making friends with our neighbors. U.S. and U.S.S.R. search and rescue satellites are working compatibly, as are the people who use them. At the end of the month, you'll be able to experience an example of what's already happening with one earth-space cooperative project that uses some of our highest communication technologies, satellites people and television, to transmit the second live, two-way audio-visual, music concert with dialog and a "wave to each other" on 40 foot screens between thousands of young people in Los Angeles and Moscow . . . a great example of creative initiatives. (Since some of our media people tend to play the bad news first, you may have to look hard for this news, but it will be there.)

Dr. von Braun taught me that we can do anything we want to do—when he proved that he could live with cancer for several years more than the few weeks the doctors had diagnosed. He told me that he could do this just as he could send rockets to the moon. The mind can create realities, he said. He encouraged me to step from the reality of an educator into the reality of the aero-military-industrial-complex. Dr. von Braun proceeded to teach me some new basics, like how important it is to apply space technology to human and Earth-environment benefits, not to thoughts of war preparation which after his life experience he believed would create more suffering. He explained that he, like some of you, perhaps, once put his professional hat above the issue and had indirectly contributed to deaths because he was doing his job . . . for the sake of security reasons. When I met him he was dedicating the rest of his life to finding ways to educate the public about space benefits.

One of von Braun's educational projects on which he assigned me to work, was the Application Technology Satellite-6 (ATS-6), the most complex, versatile communication satellite of its time. The ATS-6 provided two-way audio-visual educational programs to teachers in Appalachia and students in the Rocky Mountains, where authorities from other locations could be brought into the classroom for dialog via satellite T.V. Lives were saved during the Alaskan telemedicine experiments, where patients and paramedics in remote villages received diagnosis and prescriptions via satellite from doctors in distant major cities. The ATS-6 was loaned to India as an example of international cooperation for one year, where people in 5,000 villages with inexpensive, chicken-wire receivers, learned everything from how to brush their teeth with branches of a tree to how to plant rice crops during monsoons. Over twenty other countries and many groups used this satellite.

The sad part of the ATS-6 story is that when the ATS-6 life expectancy was over, the 90 percent paid for and completed back-up satellite was never launched, and was eventually scrapped . . . a terrible mistake, I believe. It would have taken only three of these geosynchronous orbit (22,300 miles earth) satellites to provide global education. Since the United States wasn't interested at the time, as the United States was putting dollars into defense budgets as a priority, other countries picked up where the United States left off.

Although I am not an expert in weaponry, it is clear to me that when we speak of all kinds of weapons in space, or weapons of any kind in space, we are including anti-satellites. While we are negotiating, we should all halt ASAT testing as well, as U.S. ASATs not only should begin an intensive and accelerated arms race, and destabilize our verification systems, but they also threaten our use of satellites for everyday (televisions, telephones, computers) purposes.

Since the Soviets are apparently the only people testing ASAT's at this time, if in fact they are still testing, they might view the U.S. people as wanting to stop testing only the Soviet defensive system while the U.S. people continue developing other systems, especially if we work with only the S. Res. 43 idea. And, if the U.S. people choose to test an ASAT and then try to use ASATs as a bargaining chip, since the Soviets will have no way of verifying whether or not "we" have an ASAT on board our F-15 fighter planes (since regular F-15 missiles look almost like ASATs), Americans may learn that they don't have a chip at all. Each group may be continuing to develop other space weapons since neither will believe each other's intentions are sincere. Meanwhile, the momentum of escalation based on fear will accelerate—as will danger of accidental war.

I am not naive about the difficulties of negotiating with the Soviets. The U.S. representatives have experienced great frustrations in trying to reach accord on arms issues, as, I suspect, have the Soviets been frustrated. But however difficult it is, the risks of not negotiating a comprehensive treaty are not acceptable. I continue to see how important for all of that it is for us to go back to the negotiating table with every intention of banning every single weapon system that we can imagine from space.

Soviet Leader Yuri Andropov has publically agreed to return to the negotiating table to ban all kinds of weapons from space. Again, why don't we accept this offer and this language if this is what we want—before it's too late?

Whether we trust the Soviets or not, now is the time when we can at least give the people who will be negotiating a chance. I would like to recommend that we send negotiators who have a positive attitude to do the negotiating, so that we will be successful.

FEAR MUST BE OVERCOME

The world is increasingly fearful. We, in a relatively pain free society, value our freedom and our liberty. Particularly, however, we need a freedom from fear. The current approaches to the problem of defense and security are doing nothing but increasing the fear not diminishing it. No one's sense of security is being increased by the current approaches. The military planners at any given moment feel that they can always invent a better system that gives more actual security. These military planners may feel confident in their technology that we can always invent a better counter measure for a better counter measure, which is probably true. But that doesn't make the people feel better.

May I point out that the Soviets are just as fearful as we are. We are engaged in a battle of increasing fear. Fearful people like cornered animals are dangerous. They are fearful and we are fearful. And the more the fear is increased, the more dangerous it becomes.

Our continued preparations with more sophisticated weapons does not increase our security nor our sense of security. The continued escalation of fear and terrorism is no longer acceptable to the people of the world. Today, the whole globe is our community, and our thinking must reflect this. Yet, some of our solutions are based on 19th century thinking and models which must be changed if we are to survive. People of Earth have been able to delegitimize in the last two centuries the concept of slavery and the concept of murder—previously accepted. Now is the time to delegitimize war—which represents the last vestige of the concept of legalized murder.

A POLICY TO REDUCE FEAR

What we are proposing here is asking for a space policy slanted towards reduction of the sense of fear, not the escalation of the sense of fear. This policy should lean toward building trust, decreasing fear, and building confidence.

One thing we can do is start to give information on what's going on. We should be able to take steps towards greater surveillance and more openness. Openness reduces fear. Fear produces closedness. Openness and the reduction of fear go hand in hand. You are not afraid of people you like. Then you start to gain confidence. We experience fear, distrust, and no confidence. As a result, we actually build more weapons.

I strongly recommend that the learned Senators obtain some good new knowledge from modern psychologists and psychiatrists on the nature of fear and how fear acts irrationally even when it is not consciously involved. The proof that fear exists is the fact that we feel we have to escalate, or may have to escalate.

We can create a U.S. shuttle-Soviet Salyut linkup, modeled on the earlier Apollo-Soyuz project, a Third World launch program, modeled on the cooperative European Space Agency, and a global satellite security monitoring system, for example.

I urge you to have another hearing on this issue, inviting new psychologists and psychiatrists to discuss new models of international conflict resolution, and inviting some of the people who either have feasible ideas or are already working on projects for the "new game" in space that reduce fear.

Again, nobody is suggesting unilateral disarmament, but we are suggesting thinking creatively and appealing to a different kind of thinking: focusing on a reduction of fear on both and all sides. Our creative thinking should look at greater and greater dialog, stepping up talks at all levels, and understanding the nature of fear.

CONCLUSION

The fundamental point is that the United States needs to change the game instead of playing the old game. If we don't initiate the game, someone else will. The time is here. We no longer need to wait for anything. We have the responsibility for shifting the emphasis from escalating the arms race to changing the game to the peaceful uses of outer space (and that doesn't mean peaceful as in the "MX-Peacekeeper" or "with the exception of weapons for national security"). I repeat, nothing we can do with weapons in space will make us more secure, so we have to change the game.

Anything we can think we can do.

The United States people need to establish and announce a new, positive, long range goal in space which would be developed and provide the human race with new resources, new energy and a new environment. More opportunities will exist for individuals, industries and societies than ever before . . . certainly more than during any war time.

What is needed is a new kind of creative thinking that will provide us with a security system that works. Before the window of opportunity that exists just above our earth closes off with weaponry, we can sit in the window and create a new game. The technologies, the people, and the alternatives are in place to play a new game. If you don't want to play the new game, which has already begun, you will simply be left out.

While we negotiate the new rules, we should also be developing new project ideas that will achieve our new national goal in space. Our new goal is what you on this committee are all about, peacekeeping in the United States and in the world. Again, since we know that nothing we can do with weapons in space will increase our security, we simply have to change the game. The new space game will be much more exciting and challenging . . . and will provide unlimited opportunities.

Space as a new frontier is a glamorous notion but it is also a natural barrier. Space gives us an opportunity to show our ingenuity and our creativity. We need to step back from this problem and look at it in a far more philosophic and objective way than we have our defense and arms control matters in the past.

Our intelligence is much too sophisticated and potentially even more sophisticated to ever permit an aggressor nation to really arm significantly and keep it hidden. And, if there are more dangerous weapons in the minds of man, then now is the time to make our relationships friendly. Thus, perhaps, our emphasis should be on full disclosure and observation . . . and doing this in front of the whole world. This is an example of the kind of creative thinking that is available to us.

Remember that if you are using the "human nature . . . man is an aggressive animal" reasoning to justify weapons, we know how that humans will change when they want to change. They will change more rapidly when it is in their best interest to change and will accept new approaches. It is in all of our best interest. . .

But the arms race isn't going to stop unless something new happens. All we need is the imagination and the will to create something new while we work to hold the arms race from escalation. The comprehensive treaty must be negotiated and signed immediately before it is really too late to ban all kind of weapons from space. We cannot settle for less.

When the U.S. people get attracted to new goals again, so will the people of the whole world. We need to stop defending ourselves and reacting . . . but instead to take hold of our dreams and create them.

We urge that you report out favorably S. Res. 28 and S. Con. Res. 16, and give effective leadership to secure their passage. We also urge you to continue the hearings on this important issue.

"The technologies that could destroy us can also be used for our salvation. From their very nature, space systems are uniquely adapted to provide global facilities equally beneficial to all nations."

ARTHUR CLARKE,
Author, Scientist, Futurist.

Senator PRESSLER. I would ask a brief question. Do you consider the Soviet ASAT that already exists, a threat and what will we do with it under an agreement?

Ms. ROSIN. I know that the Soviet ASATs that are being tested now threaten the low orbit satellites, as the scientists mentioned before, but they do not threaten most of our satellites on which we count for many of our defense systems and communications systems, which are too high an orbit for the Soviet unsophisticated satellites to reach.

I also know that the United States—we should take into consideration—tested the first space weapons, ASATs, in the late 1950's, early 1960's, with nuclear-tipped warheads and dismantled them because of the electromagnetic radiation pulse which was discussed earlier.

What I see happening here that is even more important is a leapfrog of technologies going out into the universe, unlike on Earth, where we have played a catchup weapons game—one building one, the other catching up, with the United States starting, in fact, in many cases. I now see the leapfrog game in which each player develops a different and better system—not an equal system—so that eventually we will not even be able to sit down and sign necessary negotiations or discuss negotiations because our space weapons systems will be so completely different, unable to verify, remove, and in irreversible momentum stages of development.

So I do not see the ASATs as the kind of hyped up threat that some people, including some media, are building that up to be. In fact, I see the United States ASATs as much more of a threat because they are not verifiable to the Soviets, and once we get into that testing and production there is no way that the Soviet Union is going to be able to verify where—or whether or not—these things are flying around on these F-15's, so we must halt ASAT and all space weapon R&D testing and development—and redirect our R&D toward peaceful applications only.

Senator PRESSLER. Thank you.

Senator Pell.

Senator PELL. Thank you very much.

Miss Rosin, I would be very interested in what you believe Wernher von Braun's thoughts would be on this whole subject, because he played such a role in development of these weapons and in the move into outer space. You worked with him, as you said, for some years.

What was his final views on it?

Ms. ROSIN. His final views would definitely have been to stop the introduction and even the thought process of putting weapons in space because of the experiences that he had had in his career. He explained to me that he wore his hat and did his job and for the sake of science and security building up systems that eventually and indirectly caused some deaths for which he was so completely sorry that he was dedicating the last few years of his life, when I met him as he was dying of cancer, to educating the public about applying technology, particularly space technology, to humanity as opposed to war and weapons.

And he talked to me specifically of reality shifts and the fact that the mind creates realities. He proved this to me by saying that even though the doctors, when I met him, had given him only a few weeks to live, that he was going to live for many more years, which he did, and that he could create this reality in his body just the same way that he could when he sent rockets to the moon and that now was the time for us to have learned from our mistakes and look at outer space with a completely new perspective that includes human potential and the applications of human potential to the development of what the mind can create.

Senator PELL. A very simple question that goes through my mind is, How can you tell on the space shuttle whether it is carrying weapons? Would you not have to have in any treaty some kind of onsite inspection?

Ms. ROSIN. Yes; keeping in mind that we talk of onsite and open in various language we have to change our perspective and language in order to fit the culture of other countries. We must learn about the ways that people have been raised and about their perspectives, in order to create a kind of onsite inspection that is not threatening and allow the Soviets and others to know everything that is on the shuttle.

If you build a wall in front of one country, sometimes it is interpreted as a defensive and sometimes as an offensive move. So when we are talking about what appears to be offensive to the Soviet Union, if that is what you are referring to, which I think is the major nature of the problem here, what I would suggest is looking at the shuttle from the Soviet perspective—which is one of fear, basically, of not knowing what weapon might be on the shuttle. I have done some studies as I was a consultant to a number of military-industrial defense contracts, is to look at the shuttle from the Soviet perspective—and then open up the U.S. information and communication channels on shuttle news. My conclusion has been that we need to create a new way of verifying what is on the shuttle which would be to develop cooperative projects specifically with the Soviet Union and, of course, with other countries, such as, for example, a Shuttle-Salyut linkup, which many people have presented as a possible alternative, which could be done right now. Also the United States could invite a cosmonaut to join onboard our shuttle, so that we begin to develop a kind of onsite inspection that is not threatening in any way but in fact is building in a reduction of the fear factor by the people involved in the fear factor itself actually working together.

And I think that is the best way to develop verifiability on the shuttle which will develop a new kind of security, based on trust and more understanding developed by working independently together. I did, on one of my contracts, do a study for which I could not even obtain

most of the information needed to fulfill the requirements due to its classified parts, so I had to go to other people who were "security cleared," but, therefore, could not talk about the facts I wanted. If I cannot get this information, how must the Soviets feel?

Senator PELL. Following up your mention of the word "cosmonaut," have there been any contacts or relationships between the cosmonauts and astronauts?

Ms. ROSIN. Yes, as a matter of fact there have been. There have been exchange programs with cosmonauts and astronauts and there will be in the future many more exchanges. I do not want to go into them in detail at this time, but there will probably be a new kind of space club forming in the not-too-distant future that includes all of the people who have lived in outer space.

We are now becoming space beings, and I think if we look at ourselves and our children as people who can now travel into space and, in fact, look at ourselves as though we are in space on a kind of a space habitat, we will begin to get more of the perspectives that the astronauts and cosmonauts do. They see the Earth with no frames and no boundaries. Then, perhaps, we shall produce some more creative initiatives.

Senator PELL. I know we are very lucky on this committee because one of our colleagues is eligible, I think, to join that club.

I imagine since your statement was terminated you would like to have it printed in full in the record.

Ms. ROSIN. Yes. I would like to present, with the committee's approval, my testimony to be included in the record in an edited version. Thank you.

Senator PRESSLER. Thank you. We really appreciate your testimony and your thoughtfulness in coming. We apologize for being a bit brief.

Thank you very much.

With that, I am going to conclude this hearing.

[Additional questions and answers follow:]

ACDA'S RESPONSES TO ADDITIONAL QUESTIONS SUBMITTED FOR THE RECORD

Question 1. During your confirmation hearings, you indicated that the United States is working on space arms control issues within the Committee on Disarmament (CD) in Geneva.

Would you tell us what initiatives the Administration is prepared to take in Geneva on space arms control?

Answer. We have noted that the United States is not opposed in principle to establishing a working group to consider the issues in greater detail and we have suggested that an appropriate next step would be for consultations regarding the substantive issues which could be addressed, and what the mandate (or terms of reference) of the working group might be. As noted in my testimony, any further initiatives would not be appropriate or prudent at this time.

Question 2. What benefits do you see in dealing with this issue in a multilateral forum, given the fact that only the United States and the Soviets are involved in developing space weapons?

Answer. A growing number of nations, including U.S. Allies, Eastern bloc countries, China and non-aligned have space programs, participate in cooperative space ventures or otherwise make use of space systems. The large U.N. votes in favor of referring the subject of space arms control to the CD indicate the widespread belief that multilateral CD discussions are appropriate. This does not, of course, preclude our undertaking whatever other consultations we deem desirable or necessary.

Question 3. Do you expect any debate on space arms control issues at the Committee on Disarmament in the coming months?

Answer. Yes. Discussion of these issues will likely continue and perhaps intensify at the summer part of the 1983 CD session. As indicated in my testimony, I would expect that the initial stages of these discussions will include examination of the present body of international law as it affects space activities.

Question 4. Our allies, led by the Italians, have strongly advocated a resumption of space arms control talks.

(a) Why do they feel so strongly about efforts to control space weaponry?

(b) Are there differences between the U.S. position and those of the allies?

(c) If so, would you explain the sources of these differences.

Answer. Our allies share our strong interest in use of outer space for such stabilizing security purposes as arms control monitoring as well, our concern about the problems posed by Soviet systems such as the anti-satellite weapon. The NATO Alliance makes considerable use of satellites in outer space for a variety of functions, such as communications, which are of great importance for Western security. Moreover, some of our Allies have their own satellite systems.

The United States seeks to address potential or real differences of view regarding its policies and those of its allies through consultations in NATO, at the Committee on Disarmament, at the U.N. and through normal diplomatic channels. Within this framework of consultation, certain of our allies have expressed an active interest in exploring possibilities for additional arms control measures affecting outer space. They also take an active role in discussions at the Committee on Disarmament, where some have stated their interest in pursuing further arms control agreements now with respect to weapons that could be used in outer space. All, however, recognize that the United States has a special responsibility to support Western security in this area, and agree with the U.S. objective not to take any steps in the arms control area that could endanger Allied security. We and our allies are working together to form a common approach to the subject which will be most beneficial to our mutual interests.

Question 5. What initiatives do you expect to be taken by the NATO allies on space issues during the coming months?

Answer. I expect the NATO Allies in the coming months will continue to consult closely with the United States at the CD to ensure that a balanced discussion of these issues takes place and that an appropriate mandate for a CD Working group is developed.

Question 6. Our allies believe that unless ASATs are banned, NATO communications could be cut in two by Soviet killer satellites in the event of a war in Europe. In your view, is this consideration a sufficient reason for seeking to ban such weapons?

Answer. Limiting the threat to the United States and NATO satellites is an important objective. As I indicated in my testimony, however, there are other important considerations, such as problems of verification, the asymmetry created by Soviet possession of an operational ASAT system, and Soviet possession of satellites that can target United States and Allied forces. If the United States were to agree to an ASAT measure that was not verifiable, that measure would provide no protection for United States/Allied satellites.

Question 7. In your view, are ASATs likely to become the MIRV of the 1980's?

Answer. The analogy with MIRVs may be oversimplified. There is already an extensive body of international law that bans nuclear weapons or other weapons of mass destruction in space, nuclear explosions in space, space ABM systems, and attacks against satellites. Moreover, as the President has said, the United States will consider arms control measures that would limit testing or deployment of specific space weapons and that are equitable, verifiable and consistent with United States security. I hope we can develop initiatives along these lines.

Question 8. Do you believe that the United States should seek a ban on space weaponry before the F-15 ASAT is deployed?

Answer. I believe that U.S. initiatives in this area must be linked to solution of the technical problems I discussed in my testimony, such as verification, and taking into account Soviet ASAT capabilities. We are proceeding with development and testing of the F-15 ASAT while at the same time addressing their problems.

Question 9. What activities has the Agency undertaken in pursuance of this authorization?

Answer. The agency has let several contracts with outside sources to study various problems of arms control measures affecting outer space including: problems of verification, taking account of potential cooperative measures; for-

mulation of potential space arms control provisions; and physical phenomena that could establish the nature of potential space weapons development.

Question 10. How many specialists at ACDA are now working on space arms control issues?

Answer. Various aspects of space and space arms control issues are treated in all four ACDA bureaus and also in the office of the General Counsel. More than a dozen people spend a significant fraction of their time on issues related to space issues and space arms control.

Question 11. Given the major verification difficulties that are likely to emerge once the U.S. ASAT is deployed, do you believe we can afford to take any more time before seeking to limit or ban ASATs?

Answer. Verification problems already exist with regard to the Soviet interceptor system and other potential Soviet ASAT systems. We cannot afford to enter into negotiations until we can develop effective verification measures to deal with Soviet capabilities and have answers to the other issues I raised in my testimony. We are currently giving priority attention to see if these issues can be resolved.

Question 12. We are now 2½ years into this Administration, and it is 3½ years since the ASAT talks were suspended; how much more time will be required before we are ready to resume space arms talks?

Answer. I cannot predict how much time may elapse before we are ready to resume space arms control talks, because it is difficult to predict how long it will take to resolve the complex issues I addressed in my testimony.

I can say, however, that we are subjecting potential arrangements to limit space weapons to intensive review.

Question 13. Has any inter-departmental group been created to treat these issues on a priority basis?

Answer. Yes. There is an inter-departmental group that addresses space arms control issues. ACDA chairs this group.

Question 14. What priority does this Administration give to seeking an ASAT agreement?

Answer. The administration seeks an agreement on outer space arms control that is equitable, verifiable, and consistent with U.S. security. This is recognized as an important subject with a high priority but one with the near-terms impediments that I mentioned earlier.

Question 15. The Soviets have offered a draft space weapons treaty. What is your assessment of the Soviet proposal?

Answer. The Soviet proposal is loosely drafted in general, and has three particularly significant problems: it bans, but does not define, "weapons" in space; it makes no provision for measures necessary to verify compliance with such a sweeping ban; and it would not affect the current Soviet interceptor deployment.

Question 16. Do you believe that the United States failure to offer a counter-proposal to that of the Soviet Union may be undermining U.S. standing in world opinion?

Answer. I believe that world opinion recognizes that the United States has made significant proposals in a broad range of arms control areas, in START, INF, MBFR, and on chemical weapons at the Committee on Disarmament. I also believe that it is widely recognized that over the last decade it has been the United States that has showed restraint in arms deployment, not the Soviet Union. For example, it is the Soviet Union that has had an operational ASAT capability since 1971 and continues to test and upgrade it, not the United States. Consequently, I believe that knowledgeable world opinion accepts as legitimate the U.S. concern over the fact that, as yet, we have not identified space arms control proposals that are equitable, verifiable, and consistent with our security.

Question 17. What benefits do you associate with resuming ASAT talks at this time? What would be the drawbacks?

Answer. In my view there would be one overriding drawback—we are not ready with sound proposals—and consequently there are no comparable advantages. I have not, however, concluded that we cannot develop such proposals and we are continuing to see if that can be done.

Question 18. Some specialists claim that with regard to the control of ASATs, we may be reaching a point of no return, beyond which agreements will be difficult to verify. Do you accept this view? If so, why? If not, why not?

Answer. Verification problems, as I discussed in my testimony, have existed for some time in this area, and continue to be a major stumbling block to space arms control negotiations. The possibility that they may become more difficult

in the future is not, in my view, sufficient reason to begin now negotiation of proposals that are not verifiable.

Question 19. Given the fact that the Soviets have an ASAT weapon, what type of verification scheme would be required for an ASAT ban?

Answer. A ban on deployment of ASAT that included a ban on deployment of the Soviet interceptor would present difficult verification problems since, as I said in my testimony, the interceptor is relatively small, easily hidden, and launched by a booster that also serves other Soviet space systems. A verification scheme sufficient to provide assurance that the weapon capability of the Soviet interceptor system had been effectively eliminated would likely require at least a large package of cooperative measures, measures which might not be adequate despite their complexity.

DR. GOTTFRIED, ADMIRAL GAYLER AND DR. GARWIN'S RESPONSES TO ADDITIONAL
QUESTIONS SUBMITTED FOR THE RECORD

Question 1. What do you regard as the most destabilizing developments in current and future space programs?

Answer. In our view the most destabilizing aspects of current and future United States and Soviet space programs are:

- (a) The continuing testing of the Soviet ASAT;
- (b) the upcoming tests of the U.S. F-15 ASAT;
- (c) the absence of any negotiations to limit the further growth of ASAT capabilities; and

- (d) President Reagan's speech of March 23, 1983, setting a U.S. course toward a perfect defense against all nuclear-armed missiles (as interpreted on national television by Secretary of Defense Weinberger on March 27, 1983).

Taken together, these actions and policies are:

- (i) planting the seeds for a capacity that will, if allowed to grow, threaten our space-borne warning systems with preemptive attack; and

- (ii) seriously imperil the ABM Treaty, and with it our confidence that our retaliatory forces continue to retain the ability to penetrate Soviet defenses.

Even though there is no scientific justification for holding out hope for a leak-proof space-based defense against nuclear weapons, the quest for such a defense will, even if futile have destabilizing consequences. In particular, the prospect of a space-based BMD system is certain to spawn the development of space mines by the adversary, which will hound the BMD platforms to assure penetration of ICBMs. Space mines will be developed even if, as is most probable, no BMD capability is ever achieved, and these mines will then threaten all objects in space, whether they carry weapons or not. This could lead to war in space as a prelude to war on Earth.

Question 2. In his March 23 speech, President Reagan stated that if laser defense was "paired with offensive systems, they can be viewed as fostering an aggressive policy."

- (a) Do you agree with this assessment?
- (b) If so, why? If not, why not?
- (c) Some have argued that if we can reduce offensive weapons to the point that they no longer appear offensive then there would be no need for a space-based BMD system. Do you agree?

Answer. (a) We agree that an effective defense against nuclear weapons, when paired with the existence of offensive systems, would "support an aggressive policy." But as we make clear in our responses to Questions 8 and 9, we do not accept the underlying assumption in the President's statement, to wit, that an effective defense against missile-borne nuclear warheads can be built.

(b) It can support a coercive policy. In fact, held by one side, such capabilities would allow world domination. Paradoxically, if offensive and perfect defensive weapons were available to both sides (leaving aside the rest of the world for the moment), there would be no feeling of serenity, since it would be quite obvious that the effectiveness of a defense might be destroyed catastrophically by sabotage, deception, or the like.

(c) We doubt that either the Soviet Union or the United States is likely to give up offensive weapons and the insurance of deterrence by threat of retaliation. Yes, we suspect that it would be easier to negotiate away offensive weapons than to build an effective space-based BMD system.

Question 3. Some government officials contend that any Soviet missile can serve as an ASAT launcher. Accordingly, it is argued, verification of an ASAT ban could be difficult, if not impossible. Do you agree with this view?

Answer. In all 20 reported tests of their ASAT interceptor over the past 15 years, the Soviets have used only one launch booster, a missile based on the old SS-9 "heavy" ICBM. Therefore, the Soviets lack ASAT experience with any other missile. Anyone who imagines that "any Soviet missile can serve as an ASAT launcher" displays a lack of awareness of the difficulties that habitually plague space hardware programs, and the Soviet ASAT program in particular. If the Soviets sought to use a different booster, they would confront several obstacles. First, if the interceptor itself has been specially designed to fit onto the SS-9 missile, it would have to be redesigned to fit a new booster, and the new configuration would require space tests to confirm that the entire system worked properly in its new form. Such tests would be visible to U.S. surveillance systems. Second, the bulk of Soviet space launch boosters and operational ICBMs have launch- and payload-weights no greater than the SS-9, and the Soviets would gain little by putting their ASAT on a different missile that was only comparable or inferior to the current booster. Third, the SS-9 itself has been phased out and replaced by the SS-18. If the Soviets sought to put their ASAT interceptor on a silo-based SS-18, then the silo too must be designed to accommodate the extra length and special launch-preparation requirements of the interceptor. Major modifications to operational silos, if they were required, would be monitored by U.S. intelligence systems, as could space test of the new SS-18/ASAT configuration.

Furthermore, our draft does not permit attacks against space objects that are in violation of the treaty's provisions; it addresses this problem in the traditional manner, by providing for withdrawal from the obligations of the treaty after due notice. Finally, our draft is bilateral.

Question 4. Your proposal bans ASAT testing but not ground-based ASAT deployments. Given the fact that the Soviets have tested their ASAT, would your proposal be in effect a one-sided ban directed against the United States? If your proposal were in force, what incentives would the Soviet Union have for agreeing to dismantle their ASAT?

Answer. Our discussion shows that our proposed treaty would not be to the "one-sided" disadvantage of the United States. If our treaty were to come into force, the U.S.S.R. will have a tested ASAT, but one which has shown itself to be very unreliable, while the United States would have under advanced development a more flexible and potent ASAT that had not yet been tested. Under the treaty regime we propose, the United States would probably be closer to a prompt, flexible, all-altitude ASAT system than the U.S.S.R., while neither existing capability would pose much of a threat to those satellites on either side that are vital if nuclear war should break out.

In striking a balance of advantage versus disadvantage, one must consider factors other than the capabilities of the two ASAT systems. Since the United States is, on balance, more dependent on satellites for its security, anything that inhibits the evolution of the Soviet ASAT threat could be viewed as a "one-sided" advantage for the United States.

The main incentive the Soviets would have for agreeing to dismantle their ASAT, would be their awareness that their current ASAT system would become progressively obsolete anyway. In the absence of space tests, the Soviets would be left with an unreliable interceptor based upon 1960's technology, while the United States remained free to adopt sophisticated measures for protecting and diversifying its satellite functions.

Question 5. Even if the Soviet ASAT capability is viewed as limited, does it not amount to a significant threat, given the high level of U.S. dependence upon a relatively small number of satellites?

Answer. The Soviet ASAT, as presently constituted, could, over a period of several days, destroy a significant portion of our space-based capability for photo reconnaissance, which is of greatest importance in peacetime. It has quite limited capability against the remainder of our space-based command, control, communications, and intelligence systems; in particular, it has virtually no capability against that portion of the system that would be employed by the strategic forces in wartime. Nevertheless, the United States should consider the desirability of various measures for protecting its satellites, or, for example, of providing ground-based back-up C³ systems for satellites important to theater conflicts.

Question 6. We have previously used national technical means of verification to observe the dismantling of launchers.

(a) Did you consider an ASAT ban involving the dismantling of Soviet ASAT launchers?

(b) If yes, why did you not adopt this as your proposal?

Answer. (a) We have considered an ASAT ban involving the dismantling of Soviet ASAT launchers.

(b) We did not adopt this as our proposal because we see no way in which the Soviets could verify that the United States had destroyed its F-15 ASAT system, and the difficulty of negotiating a non-symmetric treaty far exceeds the additional benefit we would obtain by destruction of the existing Soviet ASAT. Furthermore, dismantling of the known Soviet launch sites would not guarantee that the Soviet Union did not retain some ASAT capability.

Our draft treaty does include a provision (Article V) requiring the sides to begin negotiations on this issue immediately after a ban on space tests of ASATs is reached. However, we also recognized that provisions for dismantling ASAT systems could be quite complicated, and would, at best, require long negotiations. Hence, we view our proposed ban on further ASAT space tests as an urgent and indispensable first step toward any wider ASAT arms control measures. (For other closely selected remarks, see our response to question 11).

Question 7. Senator Matsunaga and Senator Pell are cosponsoring a concurrent resolution, S. Con. Res. 16, expressing the sense of the Congress that the President should initiate talks with the Soviet Union and other governments to explore opportunities for cooperative East-West ventures in space, as an alternative to an arms race. Do you support such a resolution?

Answer. We support the Resolution sponsored by Senators Matsunaga and Pell. We agree that cooperation in space would be an important ingredient in creating an atmosphere that would inhibit confrontation. But we do not think that such cooperation, by itself, would preclude an arms race in space. Cooperation should be viewed as one component in a diplomacy that seeks to avert such a race; the other, indispensable component, is a treaty that restricts the evolution of space-based weapons.

Question 8. Do you believe that a space-based ABM system of even limited capacity could ever be built?

Answer. A space-based ABM system of very limited capacity could be built provided the enemy abstained from taking rather simple and relatively cheap countermeasures.

Question 9. Do you believe that such a system could ever effectively protect the United States from nuclear attacks?

Answer. We are persuaded that such a system could never effectively protect the United States from an intentional large-scale missile attack from the Soviet Union, and even less could it protect against the systems the Soviets would develop in order to penetrate, circumvent, and destroy such a defensive system.

Question 10. If we do not institute effective controls on weapons in space, what do you think will be the result?

Answer. Without an effective ban on weapons in space, and a ban on anti-satellite tests and activities, we are persuaded that the striving for ASAT and ABM capabilities could lead to war in space during what would otherwise have been peacetime, which would almost certainly lead to war on earth. This is so because it is very much simpler to achieve an ASAT capability than an ABM capability. Satellites are intrinsically more vulnerable than ballistic missiles; furthermore, the nature of the satellite's trajectory allows ample time for target acquisition, and for repeated attacks. Any space-based BMD capability, therefore, has an inherent ASAT capability, even if its potency against ICBMs is actually minimal. In particular, such a nascent ABM system can preemptively destroy an imagined ABM system belonging to the other side. Furthermore, either side can, at an early stage, station space mines that have the capacity for preemptive destruction of any satellites carrying ABM systems deployed by the other.

Question 11. Why doesn't your draft treaty ban land-based ASATs? Would you favor such a ban if effective verification could be worked out?

Answer. Our treaty bans all tests of land-based ASATs in space or against objects in space. Effective verification of a provision that also bans possession of land-based ASATs would require very intrusive verification measures, including extensive on-site inspection. For example, the U.S. ASAT interceptor and its launch booster are fairly small and could readily be hidden in many places at U.S. military facilities. Even the United States might find such intrusive on-site inspection at military bases unacceptable. As for the Soviet ASAT, it could be launched from some of the boosters used in the Soviet space program. Therefore dismantling of the launchers that have been used for Soviet ASAT test shots would not, by itself, guarantee that there was no remnant Soviet ASAT capability.

One must bear in mind that the existing Soviet ASAT is intrinsically of rather limited capability. The prevention of any significant enhancement of that capability should therefore be the primary objective of U.S. policy, not the elimination of a relatively minor threat.

We recognize that a comprehensive ban on ASAT possession would be desirable, and for that reason our draft treaty, through Articles V, obligates the parties to promptly begin negotiations toward that end as soon as the ASAT test ban is in place. If a treaty that would adequately verify lack of possession could be formulated, we certainly would support it. But given the limited political capital and human resources available for any negotiation, and the urgent need for a viable restriction on the growth of ASAT capabilities, we do not favor a negotiation position that may sacrifice the attainment of an ASAT test ban to the search for a ban on possession.

[Whereupon, at 1:02 p.m., the committee adjourned, subject to call of the Chair.]

APPENDIX

WAR AND PEACE IN THE SPACE AGE¹

"We will take no frontiers into space."

Prelude to Space (1951)

Mr. Chairman, Distinguished Delegates:—It is both an honour and a responsibility to appear before you today, to discuss military activities in the last and greatest arena of human affairs.

Although this meeting is concerned with the prevention of an arms race in outer space, prevention is only one aspect of the problem. As the mathematicians would say, it is necessary but not sufficient. I shall also discuss the positive uses of space technologies for strengthening international security.

Before doing so, may I very briefly give my qualifications for addressing you. I became a member of the British Interplanetary Society in 1934, and was later its Chairman. In 1951 I presided over the first London meeting of the International Astronautical Association, and I have known most of the leading figures in the field. Only two months ago, I had the privilege of being hosted at "Star Village" by my friend Cosmonaut Alexei Leonov and his colleagues. I have written more than thirty books on space, and this month spoke at Unispace '82 as a member of the Sri Lanka Delegation.

Back in 1945, as a Royal Air Force Officer, I wrote the paper that outlined the principles of satellite communications and the use of the geostationary orbit. A few months later, my essay 'The Rocket and the Future of Warfare' won first prize in a competition set by the Royal Air Force Quarterly. It has been a strange experience reading that paper again after almost forty years, and I would like to quote the lines of Shelley with which the essay began:—

Cease! Drain not to its dregs the urn

Of bitter prophecy.

The world is weary of the past,

Oh, might it die or rest at least!

Nevertheless, "bitter prophecy" is indeed what we are concerned with today. So first, I must request you—if you have not already done so—to read Jonathan Schell's book 'The Fate of the Earth', which is the most convincing account yet given of the realities of nuclear warfare. It should be required reading for every statesman.

And yet Carl Sagan has summed up the implications of this entire book in a single chilling sentence:—"World War Two once a minute, for the length of a lazy summer afternoon."

One other reference:—I hope that you can arrange to see the BBC's recent HORIZON programme, "The Race to Ruin," which showed the first test of laser weapons on airborne targets and interviewed both American and Russian scientists on the possibilities of war in space.

This month, at Unispace '82, there was some confusion as to precisely what is meant by the "militarisation of space". There are very few of man's artifacts which cannot be equally well used for peaceful or warlike purposes; what matters is the intention. It is impossible to define a class of devices and say that "These must not be developed, because they can be employed offensively."

Let me give an example: few things would seem more remote from military affairs than the Geodetic Satellites used to detect minute irregularities in the earth's gravitational field. At first sight, this would seem to be of interest only to scientists; nevertheless, these subtle variations are of vital concern to the

¹ Address to the United Nations Committee on Disarmament, Geneva, September 31, 1982 by Arthur C. Clarke, Chancellor, University of Moratuwa, Sri Lanka, Member, Sri Lanka Delegation.

designers of intercontinental missiles, because unless the earth's gravitational field is accurately mapped, it is impossible to target a missile with precision. Thus purely scientific satellites, by greatly increasing the accuracy of warheads, can have a major impact on strategy. Yet does anyone suggest that they be prohibited?

Even meteorological satellites, one of the most benign of all applications of space technology, because they have already saved thousands of lives, are of obvious military importance.

Similarly, communications satellites would play an absolutely vital role in military operations. Yet neither represents a direct threat to peace.

Just as military helicopters can be used for disaster relief work, so some military space systems can be positively benign. Indeed, we might not be alive today without the stabilising influence of the reconnaissance satellites operated by both the U.S. and the U.S.S.R.

Let me remind you of a piece of recent history: in the early 1960s, there was a vigorous campaign in the United States claiming that the U.S.S.R. was far in advance in the development of intercontinental ballistic missiles. The so-called "missile gap" was a major theme in the Kennedy-Nixon campaign, and millions of words were written urging that the United States start a crash program to overcome the Soviet Union's enormous lead.

That missile gap was a total illusion—destroyed when American reconnaissance satellites revealed the true extent of Soviet rocket deployment. President Johnson later remarked that reconnaissance satellites had saved the United States many times the cost of the space program, by making it unnecessary to build the counter-force originally intended.

By a fantastic coincidence, just yesterday—in fact, on my flight here!—I discovered President Johnson's actual words, and I quote:—

"We were doing things we didn't need to do, we were building things we didn't need to build; we were harbouring fears we didn't need to harbour."

However, in a sense, that information may have come too late. One can picture the feelings of the Soviet military planners when contemplating this American debate. They knew they did not have the weapons the United States claimed, so what was the purpose of the exercise? Were the Americans deliberately creating an excuse to re-arm? That might have seemed the most plausible assumption—but in fact, ignorance rather than malice was the explanation. In any event, the Soviet Union decided it must produce the missiles which, at that time, existed only in the imagination of the Americans. So the seeds of a space arms race were planted, a quarter of a century ago.

It is possible to play a numbers game with payloads and launchings to prove almost anything. Statistics indicate that the Soviet Union has now launched about twice as many "military" payloads as the United States—by 1981, roughly 860 against 420. Does this mean that the Soviet Union is twice as aggressive as the United States? Not at all, because the Soviet Union's reconnaissance satellites are planned to operate for only a few weeks whereas the much bigger American satellites remain in orbit for many months. So the quantity of American reconnaissance information is probably much greater than that of the Soviet Union, a point to which we will return later.

However, photographic or TV reconnaissance is limited by cloud conditions; only radar can give all-weather coverage. And only the U.S.S.R. has used radar satellites, powered by nuclear reactors to reconnoitre the movements of ships at sea, as was revealed when Kosmos 954 crashed in Canada in 1978.

Another area of confusion and controversy is that of Landsats or earth resources satellites, which give superb views of our planet, of enormous value to farmers, industrialists, city-planners, fishermen—in fact, anyone concerned with the use and abuse of Mother Earth. The United States has made its Landsat photographs, which have a ground resolution of roughly 80 metres, available to all nations. Not surprisingly, there has been some concern about the military information that these photographs inevitably contain. That concern will be increased now that Landsat D has started operations with a resolution of 30 metres; I was stunned by the beauty and definition of the first photographs when they were shown to us at Unispace a few weeks ago. The French SPOT satellite will have even better resolution (10–20 metres) and this is rapidly approaching the area of military importance, although it is nowhere near (perhaps by a factor of one hundred) the definition of the best reconnaissance satellites under favourable conditions.

There is a continuous spectrum between the abilities of the earth resources satellites and the reconnaissance satellites, and it is impossible to say that one is military and the other is not. What matters is, again, intention.

One may sum up the situation by saying that although these satellites may be annoying to some nations, they are not aggressive: and that is the essential factor.

More confusion has now been created by the American Space Shuttle, which has been heavily criticized in the Soviet Union. It is perfectly true that many of the Shuttle's missions will be military—yet it is as potentially neutral as any other vehicle.

The one new factor the Shuttle does introduce is that, for the first time, it gives a space-faring power the ability to examine, and perhaps to retrieve, satellites belonging to somebody else, thus opening up prospects of 'space piracy'—as the Soviet Union has put it. However, one cannot help thinking that fears on this score have been greatly exaggerated. If you do not want anyone to capture your satellite, it is absurdly simple to boobytrap it and thus destroy, with very little trouble, an extremely expensive rival space system.

From past experience, I would venture a prediction in this area. When only the United States possessed reconnaissance satellites, there was a great outcry in the Soviet Union about these 'illegal spy devices'. When the Soviet Union also possessed them, this cry was suddenly stilled. In the same way, when the Soviet Shuttle is launched, perhaps we will hear no more talk of space piracy. . . .

The essential point is that all these systems—communications, meteorological, geodetic, reconnaissance, and the Shuttle itself—though they represent some degree of militarisation of space are still, for the moment, defensive or even benign. Some countries may be upset by certain applications, but they can all live with them, accepting their benefits as well as their disadvantages. The new factor which has now entered the discussion is that of deliberately destructive space systems, i.e. weapons.

It seems to have been forgotten that the first weapons were introduced into space almost twenty years ago by the United States, which exploded several nuclear warheads above the atmosphere in tests of a possible anti-satellite system. This approach was abandoned when it led to the discovery—only recently rediscovered, to the consternation of military planners—that a few nuclear blasts in space could knock out *all* satellites, simply by the intensity of the radiation pulse.

This fact hovers ominously over all discussions of space weapons systems. A desperate country could blind and cripple all its enemy's satellites—as well as everyone else's—by a few large nuclear explosions above the atmosphere.

Such lack of discrimination has led to a search for precision weapons. Since as far back as 1968, the Soviet Union has made more than twenty tests of a non-nuclear anti-satellite destroyer, or ASAT, which hovers near its victim and explodes in a shower of fragments. In June 1982, it tested this satellite system for the first time in conjunction with large scale ballistic missile launches from silos and submarines.

The interesting question arises—why are the Russians so concerned with developing an ASAT system, with its obvious destabilising implications? One can only assume that the Soviet Union, which is able to obtain a great amount of information about the U.S. military establishment by old-fashioned techniques (such as buying trade magazines on the news-stands) realizes that reconnaissance satellites are much more vital to the Americans than to itself.

Predictably, the United States has not been indifferent to this Russian lead. President Reagan has now announced the development of an ASAT system much more advanced than the Soviet satellite-killers; indeed, it introduces a new dimension into space warfare.

The American weapon is launched not from the ground, but from high-flying aircraft, thus jumping up out of the atmosphere to home on a satellite as it passes overhead. This makes it very flexible and extremely difficult to intercept, as it could be launched from any point on the earth at very short notice.

Doubtless, scientists in the Soviet Union are attempting to find a counter to this system and so the insane escalation of weapons will continue—unless something can be done to check it.

Neither the U.S. nor U.S.S.R. ASAT systems will be operational for some years, so perhaps there is a last chance to prevent the introduction of offensive (as opposed to defensive) systems into space. The importance of halting this arms race before it gets truly under way will be emphasized when one realizes that these planned ASATs are only the primitive precursors of systems now being contemplated. For a horrifying description of the next phase of space warfare I refer you to the recently published "High Frontier" study directed by General Daniel O. Graham. This envisages building scores of orbital fortresses to inter-

cept oncoming ICBMs before they could reach their targets. Such a system would cost not billions, but hundreds of billions of dollars and of course would only be a stepping stone to something even more expensive.

Which leads inevitably to the subject of laser and particle beam weapons. Now that the long-imagined 'death-ray' is technically possible, it has been seized upon as a solution to the problem of defence against nuclear missiles. A vigorous debate is in progress over the practicability of such systems and the consensus appears to be that although they are theoretically possible, it will be decades rather than years before they can become operational, except for relatively close-range purposes.

However, I am always suspicious of negative judgments, because I remember vividly the debate in the United States over the possibilities of long-range rockets in the late '40s. Let me quote again the notorious pronouncement made by the chief American defense scientist Dr. Vannevar Bush in 1945:—

"There has been a great deal said about a 3,000-mile high-angle rocket. . . . I don't think anyone in the world knows how to do such a thing, and I feel confident that it will not be done for a long period of time to come . . . I think we can leave that out of our thinking. I wish the American public would leave that out of their thinking."

The American Public did; but the Russians didn't.

If a thing is theoretically possible, and someone needs it badly enough, it will be achieved eventually, whatever the cost. And when one side develops a new system, the other will try to outdo it. The two superpowers are both led by intelligent and responsible men, yet they sometimes appear like small boys standing in a pool of gasoline—each trying to acquire more matches than the other, when a single one is more than sufficient.

It is no longer true that wars begin in the minds of men; they can now start in the circuits of computers. Yet the technologies which could destroy us can also be used for our salvation. From their very nature, space systems are uniquely adapted to provide global facilities, equally beneficial to all nations.

As you are well aware, in 1978 the French Government proposed the establishment of an International Satellite Monitoring Agency to help enforce peace treaties and to monitor military activities. This has been the subject of a detailed study by a United Nations Committee (Ref. UN Document A/AC 206/14, 16.8.81) conducted by Dr. Hubert G. Bortzmeyer. The conclusion is that such a system could well play a major role in the preservation of peace.

The operational and political difficulties are obviously very great, yet they are trivial when compared with the possible advantages. The expense—one or two billion dollars—is also hardly a valid objection. It has been estimated that its reconnaissance satellites saved the United States the best part of a trillion dollars. A global system might be an even better investment; and who can set a cash value on the price of peace?

However, the United States and the Soviet Union, anxious to preserve their joint monopoly of reconnaissance satellites, are strongly opposed to such a scheme. The British government is also lukewarm, to say the least.

Nevertheless, we have seen that in matters of great, though lesser importance, such as international communications, it is possible to have extremely effective co-operation between a hundred or more countries, even with violently opposing ideologies. INTELSAT is a prime example, as on a smaller scale is INTERSPUTNIK; and in the near future ARABSAT will establish its regional space system.

I like the name PEACESAT, and although that has already been pre-empted by the Pacific Radio Network using ATS 1, I will use the term, with due acknowledgement, for the remainder of this talk.

Reactions at Unispace '82 and elsewhere suggest that the PEACESAT is an idea whose time has come. Those who are sceptical about its practicability should realise that most of its elements are present, at least in rudimentary form, in existing or planned systems. The French SPOT satellite, with a ground resolution of 10-20 metres, has already been mentioned. Whether the superpowers wish it or not, the facilities of an embryo PEACESAT system will soon be available to all countries in the near future.

May I remind my Russian and American friends that it is wise to co-operate with the inevitable; and wiser still to *exploit* the inevitable.

PEACESATS could develop in a non-controversial manner out of what Howard Kurtz, their long-time advocate, has called the Global Information Co-operative.

This could be a consortium of agencies for weather, mapping, search and rescue, resources and pollution monitoring, disaster watch, information retrieval and, of course, communications. No one denies the need for these facilities. If they

were provided globally, they would inevitably do much of the work of a PEACE-SAT system. The only extra element required would be the evaluation and intelligence teams needed to analyse the information obtained.

The organisation, financing and operation of a PEACESAT system has been discussed in the UN report, to which I refer you for details. It is not a magic solution to *all* the problems of peace: there is no such thing. But at least it is worthy of serious consideration, as one way of escape from our present predicament—all of us standing in that pool of gasoline, making our Mutual Assured Destruction ever more assured. To quote from General Graham of the High Frontier Project:—"We should abandon this immoral and militarily bankrupt theory . . . and move from Mutual Assured Destruction to Assured Survival . . . Should the Soviet Union wish to join in this endeavour . . . we would, of course not object. . . ."

I would like to end as I began, with the conclusion of my 1946 essay, "The Rocket and the Future of Warfare."

"The only defence against the weapons of the future is to prevent them ever being used. In other words, the problem is political and not military at all. A country's armed forces can no longer defend it; the most they can promise is the destruction of the attacker. . . ."

"Upon us, the heirs to all the past and the trustees of a future which our folly can slay before its birth, lies a responsibility no other age has ever known. If we fail in our generation, those who come after us may be too few to rebuild the world, when the dust of the cities has descended, and the radiation of the rocks has died away."

The following sources have proved invaluable in the preparation of this paper:—

1. Space: The High Frontier in Perspective—Daniel Deudney (Worldwatch Paper 50, August 1982).

2. Spaceflight and the Journal of the British Interplanetary Society (27, South Lambeth Rd., London SW8 1SZ, U.K.)

3. Memoranda from Howard G. Kurtz (War Control Planners, PO Box 19127, Washington, DC, 20036).

The most detailed account of Space Militarisation will be found in Outer Space—A New Dimension of the Arms Race, edited by Bhupendra Jasani (Stockholm International Peace Research Institute, 1982.)

THE HIGH FRONTIER PROPOSAL: A CDI CRITIQUE

The Center for Defense Information has completed an analysis of the High Frontier concept of space-based defense against ballistic missiles. The results of the study are set forth in the following critique:

The High Frontier proposal for a Global Ballistic Missile Defense (GBMD) system claims that it would (1) negate the Soviet nuclear threat (2) assure the survival of the U.S. population and (3) secure space for commercial development.

The High Frontier project initially calls for space-based missile defense and ground-based point defense (a short-range defense of missile silos), to be augmented by a second tier of space-based defense (possibly employing laser weaponry), an extensive civil defense program, advanced manned military space vehicles, and more.

The architect of High Frontier, Lt. General Daniel Graham (USA-Ret.), former Director of the Defense Intelligence Agency, claims that the initial system can be deployed "off the shelf technology", within 5-6 years, and at a "reasonable cost" of \$40 billion.

These High Frontier claims are evaluated as follows:

TECHNOLOGY

Technology for a space-based ballistic missile deployment does not exist. Despite decades of U.S. efforts, there are serious doubts that the simpler task of ground-based point defense of ICBM's can be achieved, especially against relatively cheap and easy Soviet countermeasures. The High Frontier's claims of existing "off the shelf technology" have been debunked by Reagan administration officials. Dr. Robert Cooper, Assistant Secretary of Defense for Research and Engineering, said of the High Frontier proposals: "We have conducted several in-house analyses and have experienced some difficulties in ratifying the exist-

ence of 'off the shelf components or technologies' to provide the required surveillance, command and control and actually perform the intercepts . . . we are somewhat skeptical of the particular (High Frontier) GBMD concept design." He has concluded that the "enormous complexity of such a system is unmanageable today in our judgment and we need basic, I would call them, breakthroughs in the ability to manage complex systems before any such system might be feasible in the future."

TIME AND COST

The High Frontier project claims that the initial system will be ready within 5 or 6 years at the total cost of \$40 billion. However, Dr. Richard D. DeLauer, Under Secretary of Defense for Research and Engineering, has testified that the time frame and cost of the High Frontier proposal "are both grossly underestimated". Dr. Cooper concurs. He told Congress that the "DOD has worked with the High Frontier analysts . . . we do not share their optimism in being able to develop and field such a capability within their time frame and cost projections . . . Our understandings of systems implications and costs would lead us to project expenditures on the order of \$200 to \$300 billion in acquisition costs alone for the proposed systems." These DOD projections are \$160-\$260 billion higher than the High Frontier estimates.

VULNERABILITY

Space-based defense systems are flawed due to their inherent vulnerability, especially in the initial stages of deployment. Space mines could shadow each GBMD satellite (called a "truck") and be exploded upon command. Anti-satellite weapons could overwhelm the truck's defenses using decoys or tiny pellets too small to target. Any satellite can be destroyed by a nearby nuclear detonation. GBMD is vulnerable to any determined attacker.

ABROGATION OF ABM TREATY

GBMD is presently illegal. Testing or deployment of a GBMD would break the 1972 Anti-Ballistic Missile Treaty, perhaps our most valuable arms control agreement to date. Choosing an illusory technological advantage, while sacrificing such an important and stabilizing treaty, would be extremely short-sighted.

RESTRICTING PEACEFUL USES OF SPACE

A GBMD would inhibit the civilian and commercial uses of space. By inviting attack, a GBMD would, in Graham's own words, "move the arena of initial engagement in a nuclear war from the earth's surface to space." Peaceful development of space will then be more costly and risky. Satellites which serve positive functions such as arms control verification will be jeopardized. Weapons in space will not make space secure—space without weaponry is both possible and far more secure.

DANGEROUS CONSEQUENCES

Assume that the United States decided to deploy a GBMD to threaten the Soviet nuclear capability. The United States would therefore—in Soviet eyes—be in a position to launch a first strike. The Soviets might then feel impelled to launch a pre-emptive strike to prevent the deployment of our GBMD. Were the situation reversed, would we stand idly by while the Soviets deployed a system reputedly able to negate our nuclear deterrent?

NO PANACEA

Ultimately, GBMD would serve only to defend our missile silos. A GBMD cannot alter the reality of mutually assured destruction; it cannot provide mutually—or unilaterally—assured survival. Even if one accepts that GBMD could work as claimed, it could not defend our population against attacks by such weapons as cruise missiles, bombers, or "depressed trajectory" missiles launched from submarines. GBMD could not assure the survival of our citizens. General Graham clearly recognizes the limitations of High Frontier. While proclaiming that it would shift the United States from attack to defense (from destruction to survival) Graham simultaneously urges the modernization of U.S. nuclear forces with new offensive weapons with greater destructive capability. The two positions are completely inconsistent. He is not presenting an alternative to the

Administration's effort to create nuclear warfighting capability; instead, Graham is promoting a dangerous expansion of the arms race into a new dimension: space. Assuming the United States were to deploy a GBMD, so would the Soviets. Consequently, both sides would feel compelled to pursue the development of those weapons which can evade GBMD. Instead of providing a final defense or a "technological end-run on the Soviets", GBMD would only redirect and complicate the arms race.

CONCLUSION

Weapons in space will not enhance our national security or secure space for peaceful purposes. Space is not an arena into which man can transfer his vices and ignore the consequences on earth.

Already 4,800 objects (most of which are non-functional space "trash") are circling the earth. Weapons competition would soon multiply that figure many times. Ultimately, we on earth could trap ourselves inside a belt of orbiting garbage.

By placing weapons in space, we create a situation in which any internal satellite malfunction, or malfunction caused by impact of space trash, could be misinterpreted as an enemy attack. Weapons in space increase the chances of accidental war. Furthermore, the intertwined nature of space and earth-based military forces assures that any hostilities in space would be merely a prelude to war on earth. We must not delude ourselves—weapons in space cannot make us more secure. The alternative is clear; the international community must outlaw weapons in space. One relatively simple route would be to expand the 1967 Outer Space Treaty, which prohibits the stationing of nuclear weapons or other weapons of mass destruction in orbit. An amendment to ban all weapons in space would be a great achievement.

Last year at the United Nations, the Soviet Union presented a "draft treaty on the prohibition of the stationing of weapons of any kind in outer space". There is much support within the United Nations for such an agreement. The United States has yet to respond to the Soviet proposal, however, or to take significant steps toward eliminating weapons in space. Future generations will suffer unless we act now, before the opportunity evaporates.



ERRATA SHEET

S. HRG. 98-141
CONTROLLING SPACE WEAPONS

p. 55 -- Caption on photo should read:

Artist's Conception of ASAT
Target Satellite

p. 56 -- Caption on lower photo should
read:

U.S. ASAT Interceptor, Called
the "Tomato Can"